Photography for Novices.

The Primus Handbook.

NEW EDITION. ENTIRELY RE-WRITTEN.
FORTY-FIFTH THOUSAND.

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PRINCIPAL CONTENTS.

HOW TO START PHOTOGRAPHY.

MY object in writing this book is to put the reader in possession of just as much information as he requires to start his photographic career without other instruction.

Choice of Apparatus. "What camera do you advise me to buy?" is a question that has been asked me at least a thousand times, and every time I try to answer it to the best of my ability, that answer is more difficult to find. The reason of my difficulty is that the manufacturers continually offer us an ever-widening range of choice. Not only does each year afford us a greater variety of cameras, each having its own excellencies, but also each year the manufacturers seem to give us more for our money, until we are left wondering how it is done at the price.

It would be no exaggeration were I to say that the whole of this little book might easily be taken up by describing the various pros and cons of all the cameras now on the market. But any such answer as this would be no practical use to the beginner. Therefore, I shall once for all ask him to let me leave out a great deal of what *might* be said, not only in this chapter, but in all the others, so that I can fully explain those points which are really necessary for him to know.

"Simplicity is half-way to success." It is far better to know a few rock-bottom principles thoroughly than to have a smattering of many things. Now to get back again to our starting point. "What camera do I advise you to buy?" I shall reply by a question "What kind of subject appeals to you chiefly?" Is it portraiture, landscape, sporting pictures, etc.? Perhaps you will reply that you would like a camera that you can use for *anything and everything*. But while that is a very natural wish it is not a very wise one for a beginner. Half a moment's thought will show you that if you begin by trying to learn a dozen different kinds of

photography (*e.g.*, portraiture, architecture, flower studies, express trains, etc.,) you will very likely get confused and discouraged.

Whereas if you select the particular class of subject that *really* interests you, quite apart from any photographs which you may have seen, and will just stick to that at first, you may rely on being successful.

By way of example, suppose your tastes tend in the direction of landscape with or without figures, or perhaps street scenes in a town, it does not, therefore, follow that you would never attempt a portrait or an architectural subject. What I mean is that it will help you to make safe and steady progress if you select some one class of subject for your chief attention and let all others fall into a second place—at any rate until you have got a fairly good grip of your first choice.

The reason for the above advice will at once appear when I explain that there are many kinds of cameras especially arranged for certain kinds of work. For instance, we have—

Studio Cameras, chiefly designed for professional portraiture, copying pictures, etc.

Pocket Cameras, for tourists, alpine climbers.
Stand Cameras, with cunningly-contrived movements to meet the need of the student of architecture, etc.

But taking a comprehensive view we may put them all into three groups; first, Stand Cameras, *i.e.*, those which require a tripod or other stand for their support; second, Hand Cameras, *i.e.*, those which must be held in the hand; and thirdly, the more numerous kind to-day, *viz.*, "Hand or Stand," *i.e.*, those which may be used with or without a stand.

It is this last-named ("Hand or Stand") class that is most useful to the general worker, and is the kind I usually advise the beginner to select.

Again, we can subdivide "Hand or Stand" cameras into two groups, *viz.*, those that look like a black box, and commonly called "box-form" cameras, and those that shut up into a much smaller space than the rigid box-form instruments. This "shut-up-able" class are often called pocket cameras, although some of them would require rather large pockets to hold them.

Then again, we could divide cameras into those designed to use glass plates, those for flexible films, and those which may be employed for films or plates, and so on.

But as I always advise the beginner to start off with glass plates rather than films I shall have very little to say about films. For, in the first place, the companion volume to this, *viz.*, "Photography with Roll Films" (1s. net) deals very fully with the manipulation of films.

Moreover, I generally follow the plan of advising the beginner to select the simpler path first, on the principle that every lesson learnt is a help towards learning the next one; and, broadly put, the beginner will find it easier to handle glass plates than films. The fewer mistakes he makes the more will he be encouraged to go steadily forward.

But, on the other side, we must not forget that for the traveller, climber, and those in delicate health, the extra weight of glass plates compared with films is a matter of great importance. Moreover, the traveller being able to change the exposed roll of film for a new unexposed roll without resort to a

dark-room is also a very strong argument in his case for roll films, as is also the further convenience of quickness in changing the exposed part of the roll for a new unexposed part.

Of course, for these conveniences one must expect to pay something, so that we find roll films work out somewhat more costly than glass plates.

Therefore, for the stay-at-home photographer who is content with, let us say, half-a-dozen pictures in one day, the camera designed for glass plates is likely to engage his attention.

In the case of a roll film apparatus one has to expose the entire roll before development can conveniently be carried out. But with glass plates (or with cut films) we can develop any one of the exposed plates without concerning ourselves with the remainder. For the beginner this is a very valuable advantage, as by this procedure he can test his progress step by step and so economise his material.

Three shillings is the ordinary price for a roll film of twelve quarter-plate exposures, and one shilling the usual price for twelve similar sized glass plates. Suppose now that something

has gone wrong with the roll film camera, or that an error of judgment has resulted in wrong exposures having been given, then "bang" goes three shillings for the roll film, but if a trial plate is exposed and developed under similar conditions the debit side of the account is one penny.

Do not think I am all for glass plates and dead against roll films; this is by no means the case, but what I am now thinking of is to save the beginner being disappointed at the outset.

Next comes the question of what size of plate should the beginner start with. All things considered I advise the quarter-plate, *viz.*, $4\frac{1}{4} \times 3\frac{1}{4}$ inches. This is the size of the glass, and when the negative is printed and the print trimmed we get a picture 4×3 inches. This is large enough to make a pleasant memento of one's travels, and if larger pictures are required it is also a very convenient size for enlarging (see page 186, &c.) and it is also equally convenient for making lantern slides in the simplest manner, *viz.*, by contact (see page 177, &c.). Then again, the various sundries (plates, printing frames,

paper, etc.) for this size can be obtained anywhere at popular prices. A camera of this size is small enough to be carried about without fatigue.

Now comes the question of questions, *viz.*, price! You ask "How much will it cost to go in for photography?" I reply, "How much do you feel inclined to spend on your outfit?" You can, if you like, get a really practical little camera called a "Twink" for three shillings, and a working outfit for another three shillings, with which you can produce pictures a little larger than four postage stamps, edge to edge. But, of course, you must not expect to get a six-guinea outfit for six shillings.

Let us, by way of example, suppose you can spare three guineas; then I would suggest that you appropriate two-thirds of this for the camera and use the other guinea for tripod, dishes, printing frame, drying rack and other sundries, to be bought from time to time as you find out your needs.

The beginner is sometimes advised to buy the most expensive outfit that he can possibly afford. But it by no means follows that the

most costly tool is the one best fitted for your own particular needs. Then again, it is not wise to spend all one's funds at the first splash, because as you go along it is very likely to happen that you will find out that your special line of work might be greatly facilitated by an extra lens, a special shutter, enlarging apparatus, etc.

On the other hand, one *can* buy too cheaply and then find out that a few extra shillings would have included some movement that just makes all the difference between irritation and satisfaction. All these little points are worth considering so that the buyer may select the camera best suited to his own needs.

A brief review of some typical forms of cameras. Now let us examine a few typical examples so as to get a *general* idea of some of their various features.

The first three are all of the "box form" and so do not close up any smaller than here shown. One point about the cameras of this class is that if loaded up with plates, they are ready for use instantly. That is to say, there is no opening of this, screwing up of that, and pulling out the other part.

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The first three are all of the "box form" and so do not close up any smaller than here shown. One point about the cameras of this class is that if loaded up with plates, they are ready for use instantly. That is to say, there is no opening of this, screwing up of that, and pulling out the other part.

Fig 1. **The Clincher.** Easily loaded with plates in a dark-room or in a changing bag. Time and instantaneous exposures may be given. A plate that has just been exposed is quickly put in a safe part inside the camera and another one brought into position for use by simply moving a knob on the outside of the box. Small finders, really miniature cameras, are fitted in the corners, which tell us at a glance how much picture subject will be included in the negative. One shows the view when the camera is held vertically, as in the figure, the other when the camera is turned on its side, so as to give us the plate with the longer side horizontal.

Shutter speed, alterable from "time," *i.e.*, any number of seconds or minutes, to "instantaneous," *i.e.*, a small fraction of a second, as may be necessary when dealing with rapidly moving objects or scenes in strong light.

The Lens is provided with stops or diaphragms (see section on lenses) enabling us to photograph objects at various distances, and also enabling us to control the strength of light reaching the plate.

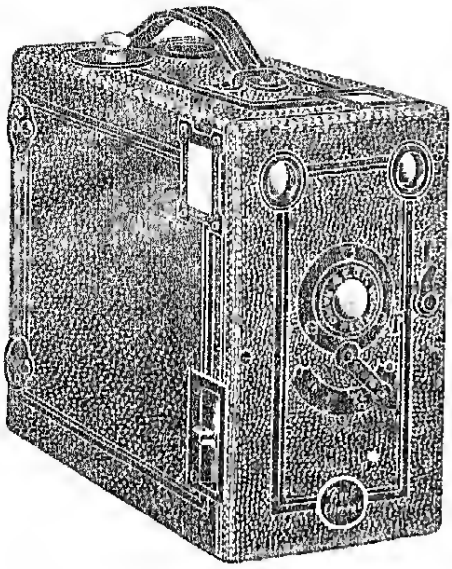


Fig. 1.—The "Clincher."

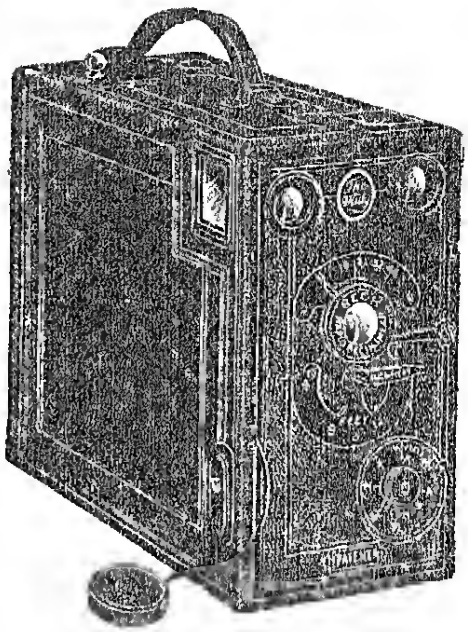


Fig. 2.—The "Midg."

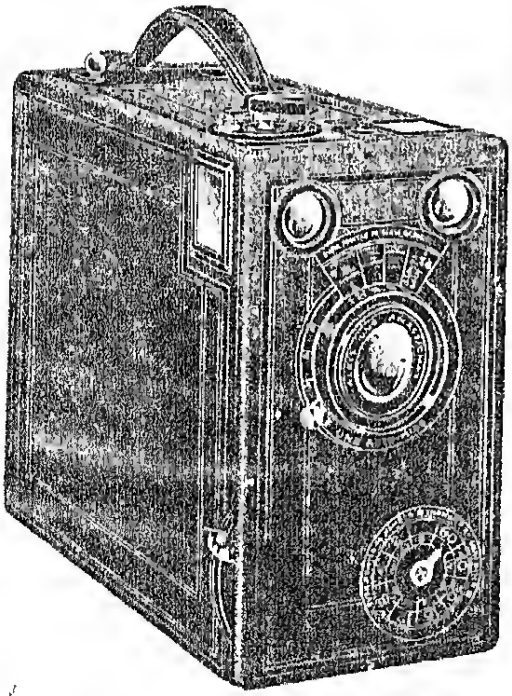


Fig. 3.—The "Acto-Midg."

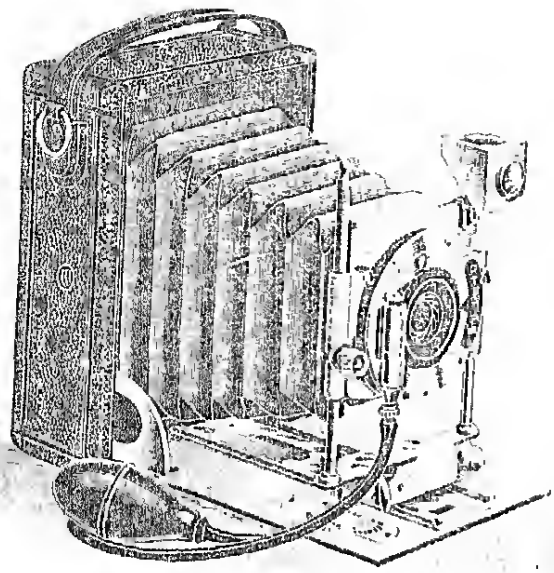


Fig. 4.—The "Cameo"

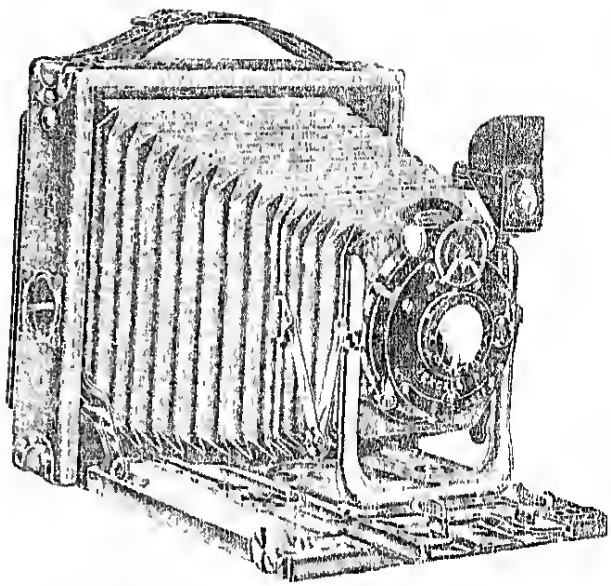


Fig. 5.—Tropical "Excelsior"

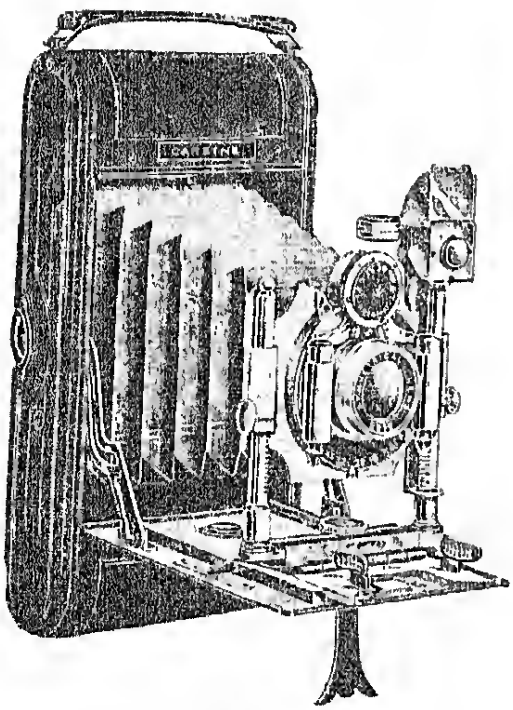


Fig. 6.—The "Carbine."

Fig. 2. The Midg. Here we have a rather more elaborate apparatus. This camera is provided with "bushes," so that it may be used on a tripod stand if desired. It is, therefore, an example of a hand and stand camera. We can open the front end or door of the camera and so get at the lens or shutter for cleaning, etc. Shutter discharged either by a finger touch or pressing the pneumatic ball. Finders, of course, are provided. The lens has iris diaphragms, giving from f/8 to f/44. The sheaths for the plates or films are provided with an automatic device which numbers the negatives as they are exposed, and outside a dial recorder tells us how many exposures we have made.

Fig. 3. The Acto-Midg. This goes still further towards the ideal and is one of the most ingenious and clever hand cameras obtainable. The special point about it is that by means of an "actinometer" (page 77) we measure the photographic activity of the light at the moment. This tells us how far to revolve the shutter speed pointer. We now set the stop according to whether our subject is a portrait, landscape, cloud and

sea, etc., and release the shutter. On firing off the shutter another ingenious mechanism brings into view a red (danger signal) disc on the top of the camera, thus telling us that another exposure must *not* be made until the plate has been changed to a place of safety. As soon as the lever for this purpose has been used and an unexposed plate brought into position the red warning disc vanishes.

We now pass to a group of "folding" cameras, *i.e.*, those having an extendible bellows, which is opened out for use and yet can be closed up into a small space either for the pocket or carrying case. In the majority, if not in all cases, cameras of this kind are "hand or stand" instruments.

Fig. 4. The Cameo. The first fresh point is that now the front of the camera, carrying the lens, can be raised or lowered, so as not to be exactly opposite the middle of the plate, when this movement is required for certain special purposes. Next, the lens flange is made on the bayonet catch principle, so that it may be taken out or replaced by a half turn of the hand instead of the usual screw-screw-screwing, which not only takes time, but is

not always easy to do without endangering the thread of the lens and flange screws.

Next we have a spring lever catch arrangement, which enables us to clamp the front securely and instantly at any desired point. Tabs fixed to the outside edges of the front end of the bellows enable us to draw this end of the bellows forward and fix them safely out of the way so that they do not interfere with our picture when using lenses of short focal length, as we often have to do in architectural and interior subjects. Further, No. 6 Cameo has a swing back working in either direction, thus enabling us to tilt the camera upwards or downwards and get the plate in the vertical plane, a condition of affairs quite essential when dealing with buildings, and in many instances of foreground subjects.

Cameras of this type are used either with plate holders or dark slides for glass plates or cut films, but are in some cases arranged for roll films.

Fig. 5. **The Tropical Excelsior.** To withstand the trying effects of considerable ranges of temperature, and also dampness, it is

necessary to have the camera properly made. The above camera is of teak, with brass-bound corners. The Russian-leather bellows are a wise precaution against the ravages of many leather-loving insects. A device on the lazy tongs principle holds the slack folds of the bellows close up to the front of the camera. The front fork is of magnalium, an alloy, remarkable for lightness and strength, and is fixed by a new thumbpiece, notably easy to use. Rising and cross front action is fully provided. The long-extension base and bellows enable the single combination of the lens to be used, and a focussing scale for the single and another for the double combination enable the user to dispense with ground-glass focussing when this is desired, while brilliant view finders and spirit level enable us to take accurate aim.

The dark slides are of the solid form, taking two plates. They are faced with ebonized metal and the ebonized draw slides are fitted with safety spring catches.

The back swings in both directions. This also is a hand or stand form and closes up into a very compact package.

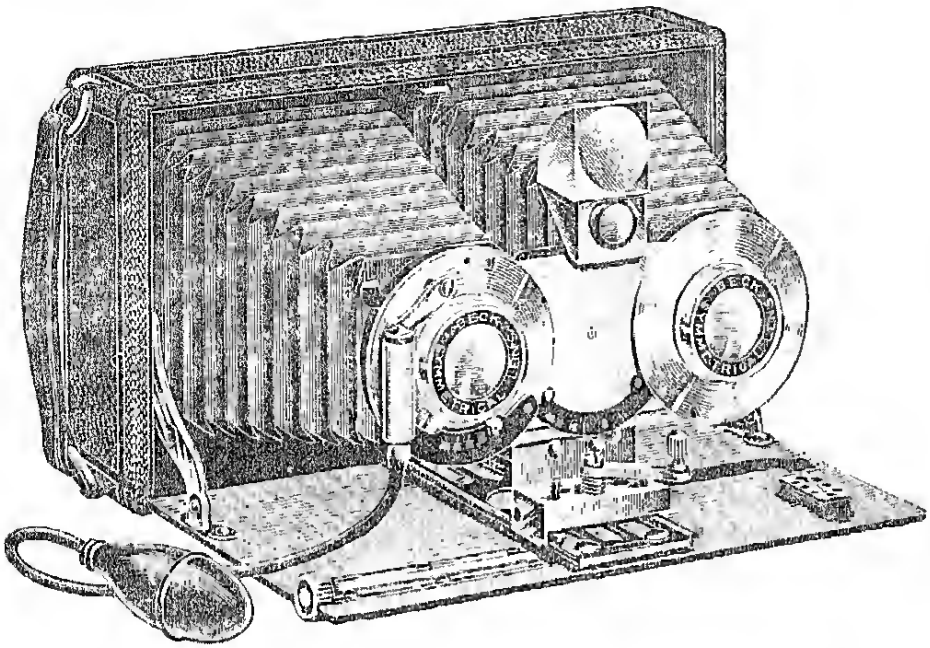


Fig. 7.—The Stereo "Ralli"

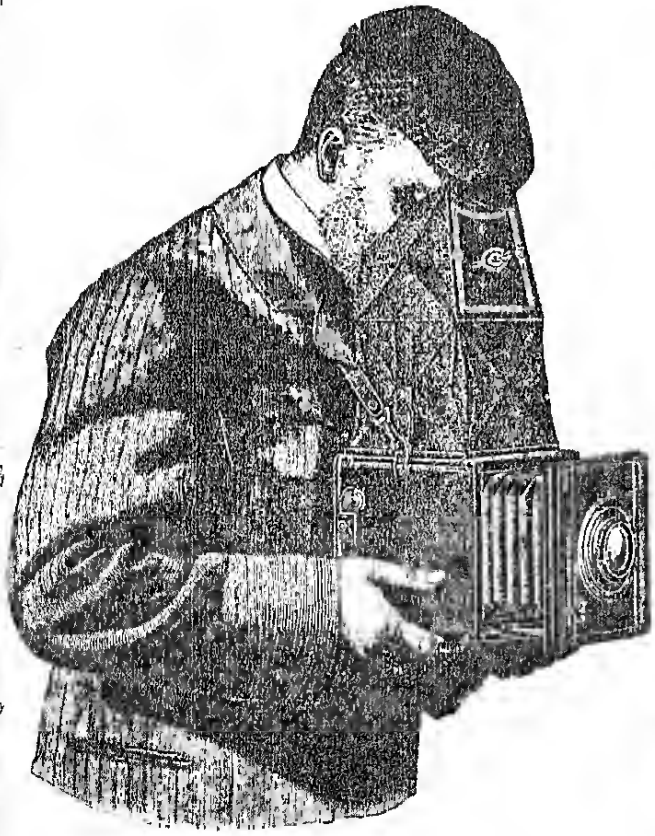


Fig. 8.

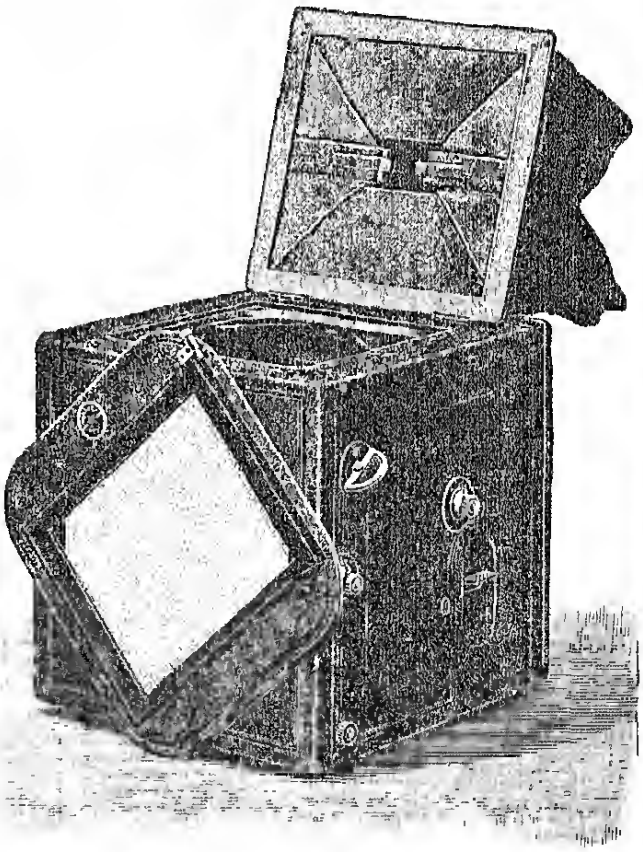


Fig. 9.—The "Pressman" Reflex

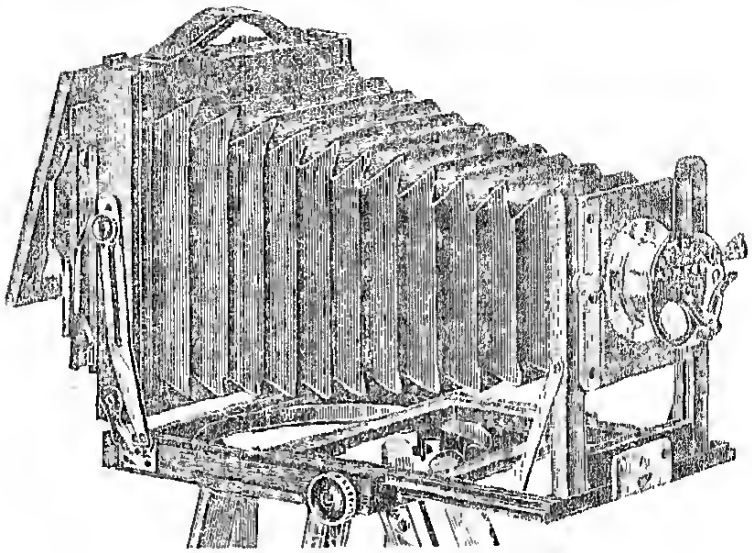


Fig 10.—The "Coronet" Outfit.

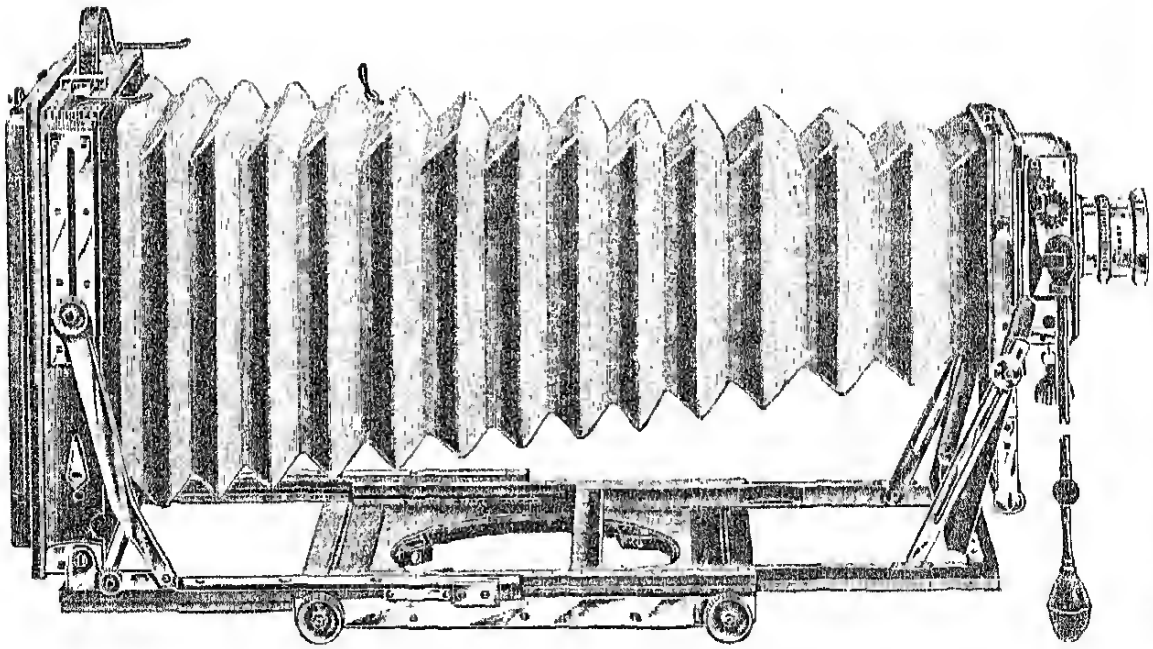


Fig. 11.—The "National" Outfit

Fig. 6. **The Carbine.** This type, as will easily be seen from the figure, is somewhat different from all the preceding. Its rounded ends will naturally suggest receptacles for revolving spools for roll films. The small folding strut under the baseboard shows how the camera may be placed on a table, shelf, top of a wall, etc., when a time exposure is required.

Like the two last-named types, this also is provided with rising front, spring catch for holding the front, and bayonet joint for lens.

In the No. 4 Carbine, for example, we have provision for the use of either plates or films, but as the position of the sensitive surface is not quite the same, two different focussing scales are consequently provided.

The shutter speeds range from 1 to $\frac{1}{100}$th second. Bushes are fitted to the baseboard and side of the camera for vertical or horizontal pictures. This form takes half-plate ($6\frac{1}{2} \times 4\frac{3}{4}$) size.

Fig. 7. **The Stereo Ralli.** The essential ideas of stereoscopic photography are briefly given on page 172. A glance at fig. 7 shows us two practically identical little cameras side

by side, like the Siamese twins. One touch of the focussing screw operates both lenses and similarly the same pressure of the shutter bulb brings both lenses into action at the same moment.

The usual size of a stereoscopic negative is $6\frac{3}{4} \times 3\frac{1}{4}$, enabling us to get a pair of (right-eye and left-eye) prints from the one negative.

The reader who is interested in stereoscopic work should obtain Messrs. Butcher's (gratis) booklet on "Stereoscopic Photography," which gives full information as to apparatus, etc.

Figs. 8 and 9. Pressman Reflex. We now go back to the box form—but here it is combined with a bellows extension at the lens end of the box, so we might call it a bellows-box-form camera. Opposite the lens is a ground glass for focussing when the camera is supported on a tripod. Instead of turning the camera round on to its side we merely turn the back or end of the box round (fig. 9) and thus get horizontal or vertical pictures at will. This device is called a revolving back.

But supposing the instrument is being used as a hand camera (fig. 8), we have on the top a collapsable tunnel or hood rising up towards

the face and so shutting out extraneous light, and thus enabling the operator to see his picture on a *second* ground-glass focussing screen, which forms the flat top of the box part. On this horizontal focussing screen the image from the lens is projected by means of a mirror inside the camera. So long as this mirror is in position for thus viewing the image no light passes to the back end of the camera.

A focal-plane shutter is generally used in this type of instrument. Focussing is done by means of a milled-head screw at the side of the camera.

The special point about this type of camera is that it enables the operator to focus by eye and not by scale. Moreover, focussing can be done right up to the immediate instant when the shutter is discharged and exposure made, thus enabling the worker to follow the rapid changes of position of moving objects; for instance, a group of players rushing about a football field, a boat entering the harbour, birds on the wing, people and vehicles moving in the street. Hence its especial suitability for sporting and press-work photography.

In order to free the operator's hands the camera can be supported by a strap passing over his neck and shoulders.

The operations are outlined as follows: As soon as the reflector is set (by means of an outside lever) the back part becomes light-tight, as all light entering the lens is thrown by the reflector upwards to the top ground glass. We may now insert our plate at the back or end of the camera and withdraw its shutter slide as it is in a light-tight dark chamber. The shutter is set with the width of opening in the roller blind at the desired aperture. We can now see our picture on the ground glass and alter the focus at will and then at the critical moment a touch of the finger on the shutter trigger removes the mirror and that in turn fires off the shutter, making the exposure.

We now break away from hand camera instruments and glance on two typical forms of camera designed for use when supported by a tripod.

Fig. 10. **The Coronet** is an excellent example of a modern up-to-date stand camera. The circular opening in the baseboard indicates

a revolving arrangement or "turntable," whereby the camera can be turned horizontally in any direction without shifting the tripod legs. The focussing screen is hinged to the camera and so cannot be dropped by accident. Rising front and swing back movements are, of course, included. The base consists of two similar portions controlled by rack and pinion, thus giving us "double extension," enabling us to use lenses of different focal lengths.

Fig. 11. The National. Here we go several stages further. The base, consisting of three parts, gives us "triple extension," and consequently a great bellows (or lens to plate) range of distance. A glance at fig. 11 shows us that we get still further movements of the front or "lens board," giving not only length but extra rise and fall movements—which are so valuable when dealing with architectural subjects in confined situations. Focussing can be done by means of either of the rack and pinion fitments. A swing back is, of course, fully provided. With this type of camera we can use lenses of either very long or very short focal lengths. As in the case of the Reflex, fig. 9, so here also we have a revolving

back for horizontal or vertical pictures. Any lens or any shutter can be fitted to suit the worker's needs.

Variations in the different types. It must be now said that the above descriptions are types or samples, as it were, of the different general arrangements, and that under each type we may get numerous variations, not only as to size of plate, quarter, post-card, stereo and so on, but that the lenses are variable and that the more expensive models have correspondingly extra fitments or movements. These are so very numerous that details must, of course, be sought from the fountain head, *viz.*, the dealer or manufacturer.

Moreover, camera designing never stands still, so that each month brings this or that advance towards the ideal.

We may now take a detailed glance at fig. 12, which shows us the various parts of the camera and at the same time take note of their use.

A. Plumb indicator, which tells us when the swing back is truly vertical, a matter of first importance in all architectural work.

B. Dark slides, also called plate holders.

C. Back; and D front focussing screw, controlling the racks and pinions and thus enabling us to shift either the ground glass or lens board. This choice is of especial value when copying pictures.

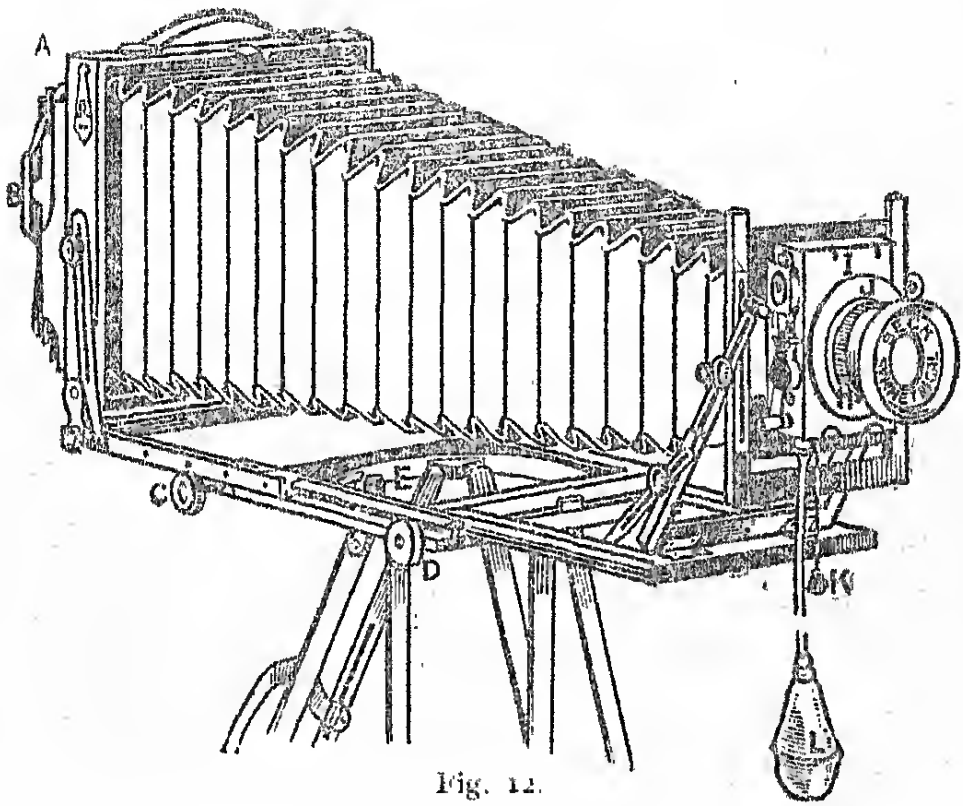


Fig. 12.

E. Turntable, to which are fitted the top ends of the tripod legs. This gives the camera a broad and steady support, and enables us to turn it about horizontally without altering the position of the tripod itself.

F and G. Milled-head screws and struts, for controlling the position of the rising front and thus altering the position of the foreground limits.

H. Iris diaphragm.

I. Shutter, of roller blind type. In this case it is put *behind* the lens.

J. Flange of lens, fixed to front of shutter.

K. Pulling the cord K winds up the spring and so sets the shutter.

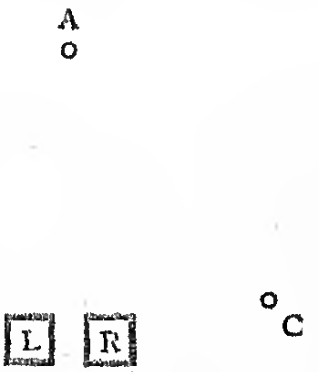
L. Pressing this bulb releases the shutter and makes the exposure.

The back and front may be brought near together for work with a lens of short focal length.

Arranging the Tripod. I shall now take it for granted that you have bought your camera and tripod, also that when buying the camera you asked the seller to explain to you all its movements, *i.e.*, how to put in and take out the plates and so on. Naturally you are anxious to start off "full speed ahead" and secure a prize medal picture *instanter*. But take my advice and go very slowly for a few minutes. Let us have a private rehearsal, so that you may get to know your camera by

finger touch as well as by eyesight, so that when the need arises—as it very soon will—you may be able to perform any of the operations, *e.g.*, changing plates, setting the shutter, and so on, without looking at the camera at all, but being guided entirely by the sense of touch.

Take the apparatus out into the back yard so that you may not be "flustered" by anyone looking on and making the usual silly remarks.



First of all set up the tripod and spend a few minutes learning how to tilt the top this way and that with certainty and quickness. I have seen photographers who have been using a camera for twelve months or more fumbling about and tripping themselves up in a perfectly childish manner—all the result of not starting the right way. Therefore,

begin at once by seizing one leg of the tripod in each hand so that the third leg is away from you, as shown in the diagram on preceding page.

L and R are your left and right feet on the ground. A, B, and C are the tripod points.

Now notice that when A, B, and C are the same distance apart the tripod top, and consequently the camera, is level. Moving A forward, or, what comes to the same thing, bringing B and C nearer together, points the camera downwards.

Increasing the distance on the ground between all three points A, B and C brings the camera nearer the ground. The same effect can be produced without moving the points if the tripod is fitted with "sliding legs."

An exceptional case. Occasionally we wish to point the camera upwards at a considerable angle, for instance, when photographing the upper part of a building. In that case it *may* be necessary to reverse the position of A, B, and C, that is to say, arranging for one leg to come between the operator's legs. But if this be done one has to be careful not to damage or disturb this leg when moving about.

A few words about focussing the image or picture. If the camera is of the "fixed-focus" kind then, of course, the distance between the lens and plate is a fixed quantity and cannot be altered. This means that we can only deal with objects which are not nearer than a certain distance (what this distance is you can learn from the vendor of the camera). But in some fixed-focus cameras we have an arrangement by which we can bring some extra ("supplementary" or "magnifier") lenses into play, and this contrivance enables us to deal with objects nearer.

The "fixed-focus" arrangement, with or without "magnifiers" is the usual one with box-form cameras. But we must not conclude that all box-form cameras are fixed focus, for there are several excellent patterns which have a rack and pinion focussing arrangement, and this is often a very valuable feature. The folding or pocket cameras and also the landscape or stand cameras practically always have a focussing arrangement by rack and pinion.

Focussing by scale, or "ground glass." Box-form cameras very generally are of the magazine

kind—*i.e.*, the plates are put into their metal sheaths and stored up for use inside the camera. In that case no focussing screen is practical, so that we have to ascertain the distance of the object to be photographed either by actual measurement or guessing it by eye judgment, and then setting the lens by means of a "focussing scale." This eye-estimating may sound rather a formidable business, but it is easily learned with a little careful practice.

Where the camera is provided with a "focussing screen" or "ground glass," as it is sometimes called, then focussing is done by examining the picture or image by eye inspection.

Just at first you may have a little difficulty in seeing anything at all on the ground glass. Very likely your face is too near the ground glass and you are focussing your eyes to look *through* instead of *at* the ground glass. Then again, the more you can keep out extraneous light, by means either of a focussing cloth or focussing hood, the better you will see the image. Also do not forget that the ground-glass picture is upside down and is, of course, on a quite small scale, so that a big tree may appear to be quite a tiny bush. Then again,

perhaps you have been looking at some brightly sunlit object, and the eyes are dazzled with the light, but if you will shut your eyes for a few seconds so as to rest them from the bright light, and then open them slowly under the focussing cloth you will probably be surprised to find how much you can now easily see, compared with what you could see when you first put your head under the focussing cloth.

Bearing these hints in mind, we are now ready to fix the camera to the tripod, by means of the "camera screw," which passes through the "tripod top" and screws into a hole or "bush" in the base of the camera. Turn now to the lens and arrange to use the "stop" or "diaphragm" with the *largest* opening. Then point your camera at the most distant thing available—say a tree—and move the lens to and fro until the image of the tree is "in focus," *i.e.*, sharply defined on the ground glass. Very likely other (nearer) parts of the scene will be fuzzy or "out of focus." Do not trouble about that just now, but notice that a very slight turn of the focussing screw either way puts the image of the tree out of focus. Now make a mental note of the

distance between the lens and opposite end of the camera so that at any future time you can at once bring the lens to somewhere near the position required for distant objects.

Next turn your camera to some other subject where you have a *near* object, *e.g.*, a gate, say four or five yards away, and a *distant* object, *e.g.*, a tree, thirty or more yards away. If now you focus for the distant object, probably the near one will not be sharp and if you alter the position of the lens to get the near object in sharp focus, then the distant one will be out of focus. Suppose now there is a third object —say a building—about twice as far away as the gate, *i.e.*, eight or ten yards away, and you focus for this building. Then the near gate and distant tree are neither quite sharp nor yet so fuzzy as they were before. Then without altering the focus turn to your lens and use a stop with a medium-sized opening, *i.e.*, one about midway between the largest and smallest of your stops. Examining the ground glass picture you will now find that while changing the stop has not made very much difference to the building, it has made the distant tree and near gate both sharper

You have now got hold of the fundamental facts about stops, *viz.*, that if you focus an object at moderate distance with a large stop and then insert a smaller stop this sharpens up the focus of both nearer and more distant objects.

You will now see that one reason why a lens is provided with stops is to enable you to focus objects at different distances at the same time. You must also notice that with the smaller stop your picture on the ground glass is, generally speaking, darker than it was when the larger stop was in use. Obviously this is the result of shutting out or "stopping" some of the light, just as partly closing the window shutter in a room darkens the room. You now see why the "stops" are so called. The smaller the opening, the more light is blocked out by the stop. The obvious consequence is that the smaller stop opening requires a longer time of exposure than the larger stop opening. Thus, while the smaller stop gives us what is called greater "depth of focus," *i.e.*, a deeper range of sharp definition, this has to be paid for by longer exposure, which means more blurring in the case of moving objects.

Dry Plates, as they are now commonly called, are pieces of glass coated with a thin layer or " film " of a yellowish substance which is extremely sensitive to light, so that they have to be manufactured in a room lit by a very feeble red light and handled with great care. They are sent out in cardboard boxes, each containing one dozen plates, packed in pairs, face to face, *i.e.*, film side towards film side. Usually two such pairs are wrapped up in thin brown paper, so that the box contains three such paper packets of two pairs or four plates, thus making the twelve plates all told. It is important to understand this packing arrangement and remember that the first plate has the film side down, the next film side up and so on, because, when travelling about, one often has to load and unload the camera in some dark cupboard or under the bed clothes, and so our only guide is finger touch.

Storing Dry Plates. As these plates are very sensitive to light I need hardly say that the box must on no account be opened in any place except the " dark-room," *i.e.*, lit by dim ruby light. And even there the box should

be opened as far away from the red lamp as is convenient, the plates taken out and the lid put on the box containing the remaining plates at once, lest it be forgotten and the door opened or light turned up, which might spoil all the unused plates left in the box.

Also plates should be kept in a dry and cool place and preferably where gas is not burned: under these conditions they will keep good for many months.

Loading the Camera or Dark Slides. With a penknife neatly remove the part of the box wrapping paper which covers the *end* of the box, so that the box now slides in and out of its paper casing. This may be done in daylight. Make it your invariable rule always to keep any box which contains any unexposed plates in this outer paper casing. This will prevent your inadvertently opening a box containing sensitive plates and probably spoiling the lot.

Now retire to your dark-room, light the lamp, but do not turn it full up just at first. Let your eyes get accustomed to the dim light. After a few minutes in the dark-room you will be able to see quite easily things which were not visible at first. It is a good plan to close

and rest the eyes for about one minute just at first. Arrange the lamp to your right or left rather than facing you, so that the light falls on your work table and not into your eyes. Having removed, let us say, four plates from a box when in the dark-room, return the closed box to its outer casing and write with pencil the number (8) of plates now left in the box.

Take one plate and hold it so that the light from the lamp "glints," or is reflected first by one surface and then the other. You will at once notice that the glass side shows a sharp outline reflection while the "film" or coated only gives a dull blurred kind of reflection. If your fingers are dry and clean you may, "just for this once," run a finger tip along the edge of the coated side and compare this with the feel of the glass side. Sometime you may find this sense of feeling very valuable. You must remember that, in any case, the film side of the plate when in the camera has to be towards the lens. So that if you are loading up double backs the two plates will be back to back, or glass side to glass side (with the opaque partition between them, of course) so that the film sides are out and so will face the

lens. If the camera is a magazine, carrying the plates in sheaths, the glass side will go next the sheath. A little care will be required to see that when the loaded sheaths are put into the camera that the film side is facing the lens.

Just now I suggested your examining *one* plate carefully by the aid of the dark-room lamp, but for the rest of your photographic life it should not be necessary to do this again. The less light the plates see when passing from the box to the sheath or plate holder, the better.

A Trial Exposure. We are now ready to try our hand at making a negative. Nearly every beginner makes one of two mistakes at starting. Either he tries a portrait or a view of some kind with very near and very distant objects in it. These are both cases calling for special treatment and some previous experience, and, therefore, not at all suitable for a start.

Let us content ourselves with something much more simple, such as a bit of the garden, not too near, not too far away. Suppose the nearest part is 5 yards and the most distant part not more than 20 yards; or if you prefer

it you may begin with a cottage by the road side, with perhaps a tree or two near the-building.

Having arranged the camera and focussed the picture on the ground glass, then comes the question of how long the exposure shall be.

Now I do not want to alarm the beginner, but it is well for him to know that this is a most important matter, that it depends on many things, and that during all his photographic life he will always be learning and accumulating experience about exposure. Roughly put, the factors we have to take into account are: A the light falling on the subject; B the stop in the lens; C the colour of the subject; D the speed or sensitiveness of the plate.

Fig. 13.

Now as regards the photographic activity, or value of the light, we can arrive at this in two different ways. First we can measure it by an actinometer.

The accompanying fig. 13, shows one of the popular forms of this instrument, which

is about the same size as an ordinary watch, and costs about half-a-crown. The second method for ascertaining the value of the light is to consult a table of average light values for any hour of any month of the year. Tables of this kind are printed on a card which can be carried in the pocket.

Opinions vary considerably as to the relative merits of these two systems: both are useful, but neither is perfect.

Our subjects we can fairly easily classify as portraits in studio, in room, outdoor, open landscape, foreground landscape, and so on. As regards the stops, if we know the correct exposure under a certain set of conditions for one stop we know it for them all, because the stops are of such a size that the exposures are in the ratio of 1, 2, 4, 8, 16, and so on, or in other words the exposure with any one stop is double that of the next smaller or half that of the next larger.

The speed or sensitiveness of the plate is usually indicated by some number on the box. (See note on H. and D. speeds).

Now in order to simplify matters I strongly urge the beginner to select a plate of medium

rapidity and to stick to that brand until he has got his hand well into his work. Any chopping and changing will only introduce needless confusion and bring no gain.

I advise the selection of a plate with H. and D. speed between 100 and 150.

All things considered it will perhaps be best for the beginner to discard tables, actinometers, &c., for the first two or three experiments, and make a trial relying on his own idea of the light reaching the ground glass.

Let us suppose we have a fine but not necessarily sunshiny day, and that the sun has been risen about a couple of hours, *i.e.*, May, June, July, August, between 7 a.m. and 5 p.m.; March, April, September, October, between 9 a.m. and 3 p.m.; November, December, January, and February, between 10 a.m. and 2 p.m. Suppose the subject is not very near, not very far as above described. Suppose the plate to be of speed somewhere between 100 and 150 H. and D., and the stop to be F/8.

Now let us give an exposure of 1-10th of a second. For the summer months this may be

too much, but for the winter months it may prove too little.

The Dark-Room. Of course it is a great convenience to have a room which can be set apart for our photographic operations, but many modern improvements have rendered this not essential. If a room cannot be arranged for, then I urge the worker to arrange to have a shelf or two or a good sized box wherein he can keep all his bottles, dishes, &c., *together*, and so be able at a moment's notice to lay his hand upon anything he may want.

The dealers provide us with two or three forms of portable sinks filled up with shelves, cupboards, and so on. When something of this kind can be afforded it will be found a great luxury and convenience.

But what we have to remember is that our dark room must be some place from which we can shut out *all* daylight, but yet have plenty of air to breath, or headache will surely follow.

A window can easily be blocked out temporily by making a light wooden framework which fits the window and is held in position when so required by turn buttons. This frame

is covered with the cheapest calico to which is pasted a layer of newspaper, and on the top of that a layer of brown paper. The whole thing can be home made for a very trifling sum, and need not be unsightly or an inconvenience to anyone. If the door is a bad fit, or is towards any very light place a few hooks may be screwed into the top of the door frame and a curtain hung over the door by means of curtain rings passed over the hooks.

Keep the floor, and other parts of the dark room as clean and dust free as possible, as dust is the photographers' enemy. It settles on his plates causing spots, gets inside his camera causing it to work stiffly, and does all kinds of irritating things.

Water Supply. If you are in luck's way you will have a sink and water supply in your bath-room—dark-room, or possibly scullery—dark-room. But if not then you will have to provide yourself with a good-sized jug or can of clean cold water, and also a bucket or some such receptacle for your spent and used solutions, wash water, and so on.

A rough towel upon which one may dry one's fingers should be at hand. It is a good plan to

convert this into an apron for the moment. This may easily be done by passing a good stout string round the waist, tying it, and then passing the towel inside the string so that it hangs down in a double fold. Thus it serves to protect one's clothes and is always at hand in the dark.

Dark-room Lamp. This is one of the most important, most abused and sadly neglected part of the kit. A man will cheerfully spend five guineas on a showy camera and then begrudge half-a-crown for a decent lamp. This is folly, because a faulty lamp may be the cause of spoiling scores of negatives. The camera maker, lens maker, plate maker, and chemical dealer have all to share the blame which not seldom should be given to the photographer himself for not buying a really reliable lamp. When buying a lamp bear in mind the following points. It must be large enough to give you as much light as you need. It must be so constructed that either it is not easily upset, or, as I prefer, is attachable to the wall. It must have good ventilation, and so not get overheated. If for oil it must have a good burner, which can easily be kept clean,

or it will soon become unbearably "smelly." And most important of all it must have deep ruby glass of good quality, preferably what is called "double flashed"—*i.e.*, white glass coated or flashed on each side with a thin layer of ruby glass.

What is a Safe Light. To be precise there is probably no such thing as a safe light in the strict photographic sense, because if a photographic plate be exposed *long enough* to any light it will *in time* be affected. But in practice we can select certain kinds of glass which permit only rays of a certain colour to pass through them. Now ordinary dry plates are very much more sensitive to blue rays than they are to red rays. If then our lamp glass only transmits these deep red rays which take perhaps ten minutes to produce any appreciable effect on the plate, and we only expose our plate in the dark room for a few seconds, then the red light has not time to do any harm.

One Bit of General Advice. No matter how safe your lamp may be, do not forget that no light at all is safer still. Therefore, keep as far away from the lamp as you can when

manipulating a sensitive plate, be as quick as you can (in reason), and keep the developing dish covered over by a piece of stout card or thin wood as much as possible. Herein is largely the secret of obtaining bright looking and quick printing negatives, which enlarge well, and yield bright lantern slides.

Developing our Trial Exposure. With a view to simplicity I advise the beginner to start with Rodinal as his developing agent, because it is a liquid which only requires diluting with water to give us a developer ready for use. The stock solution keeps a long time so that in the end it proves economical for the beginner. But later on the worker may prefer to use some other developers.

We require a 3-oz. bottle of Rodinal (1s. 6d.), 1-oz. Potassium Bromide (2d.), 1 pound Hypo-sulphite of Soda (generally known as "Hypo") (2d.), a set of scales and weights, weights up to one dram (1s. 6d.), a one-dram glass graduate or measuring glass for liquids (3d.), a two-ounce ditto (4d.), a quarter-plate ($4\frac{1}{4} \times 3\frac{1}{4}$) Xylonite developing dish (4d.), a fixing bath, *i.e.*, porcelain deep dish which may be any

size not less than the plate. It is, however, very convenient to have a fixing bath large enough to hold four quarter-plates, *i.e.*, 9 × 7, at one time (this costs about 1s. 6d.). We also require a washing tank for 12 plates (costing about 1s. 6d.), and a draining and drying rack (costing about 6d. and upwards). An empty and clean wine bottle will be useful. We also require two clean one-ounce bottles with new and sound corks (1d. each).

We begin by preparing the fixing bath, as that requires a few minutes. Take ¼ "hypo." You need not weigh this but simply divide up the pound into 4 equal parts as evenly as possible. Put this in the wine bottle and add 16 ozs. luke warm water, *i.e.*, eight times the contents of the 2-oz. measure. Turn the bottle and contents over and over for a few minutes, noticing that as the hypo dissolves the bottle feels colder and colder. This explains why we started with luke warm water. For had we used cold tap water the mixture would have become so cold that it would work very slowly.

Now cut a narrow nick length ways along the side of the cork of one of the one-ounce

A (20 secs.) B (40 secs.) C (80 secs.)

Fig. 14. Bromide Print, different exposures. same development. (See page 122.)

A. B. C.

Fig. 15. Bromide Print, same exposures, different development. (See page 123.)

bottles, half fill it with water, insert the cork, invert the bottle and see if the nick lets out a steady stream of drops—*i.e.*, one drop every second or so. If they come out too slowly enlarge the nick a little. Then empty the bottle. Next fix up the scales and weights, and weigh out 48 grains of Potassium Bromide (remember that one dram is equal to 60 grains). Put the 48 grains of Bromide in the bottle and add just one ounce of cold water. Label this bottle Potass. Bromide 10%. Next notice the "cork" of the Rodinal bottle is not cork but rubber. The way to get it in and out is to twist it round and round, but always twist it one way. Having opened your stock bottle of Rodinal pour about half an-ounce of the Rodinal solution into the second one-ounce bottle, then put away your stock bottle of Rodenal out of the way in a safe place, and use from the little bottle. Now to prepare a developer for a properly exposed plate we measure 25 minims of Rodinal with the smaller measure, put this into the larger (2-oz.) measure, and fill up with water to the 1-oz. mark. Observe that the one dram measure indicates 60 minims per dram, and that there

are 8 fluid drams in a fluid ounce. A minim is a fixed quantity and may or may not be the same as a drop because the size of a drop depends upon the nature of the liquid, the size and shape of the vessel from which the drop falls, and so on, but for our purpose a drop of water is usually just about a minim.

All being now ready we can turn out all light except that from the red lamp, and then rest our eyes for half a minute by closing them. Remove the exposed plate from the dark slide or sheath as the case may be (handling it by opposite edges only) and place the plate glass side down, *i.e.*, film side up in the developing dish. You will not fail to notice that although the plate has been "exposed" in the camera yet the image is "latent," *i.e.*, hidden, and requires developing to make it visible. Give a glance at your watch and just as the seconds hand completes a minute quietly pour over the plate your mixed ounce of dilute Rodinal developer. Rock the dish by slightly lowering alternately the right and left hand, then rock the other way by raising and depressing the front edge. In this way all parts of the surface are equally fairly treated. The rocking should

be done quite slowly. If quickly done, as some beginners imagine to be necessary, the developer is churned up into froth and bubbles, which produce markings on the plate. Violent rocking also tends to weaken the developer by needless exposure to air. In a few seconds probably you will notice here and there that the plate is beginning to darken, *i.e.*, the developer is locating the action of light. Where the brightest light fell on the plate most action has taken place, and this part first responds to the developer. Now I want you to keep a sharp look out for the first visible bit of darkening and then glance at your watch, noting how many seconds have elapsed between pouring on the developer and the first appearance of darkening of the image. Let us suppose this interval to be 10 seconds. Now dividing 10 by 2 we get 5, and then say to ourselves that this plate ought to be just about sufficiently developed in five minutes, *i.e.*, half as many minutes as it takes seconds for the developing action to *begin* to show. Please understand you are not to take this as a cast-iron rule, but only as a rough yet useful guide for anyone who has to work alone. On

this first occasion you are to be allowed to watch the plate gradually coming out as a "negative"—*i.e.*, dark where nature is light, and light where nature is dark, but subsequently you must get into the way of pouring on the developer and then covering the developing dish with a piece of stout card, *e.g.*, yellow straw board, and only glancing at the plate for a second to see that there are no air bubbles, and then keeping it covered up from even ruby light until it is just about ready to come out of the developer and be "fixed." But the first plate may be watched all the time if we keep well away from the red lamp and yet can just see what is going on. Probably if the plate has been very fully exposed you will find that it seems to be darkening *all over*, but if it has been under exposed development seems to go on up to a certain point and then cease, leaving certain parts *much* lighter than others.

When to Stop Developing. Naturally this is a great puzzle for the beginner, because he has no experience to fall back on, and the necessary knowledge can only come by experience. But I can give a few hints which may help.

First we look *at* the plate by reflected light. In the parts corresponding to the darkest parts of the original we expect to see a slight greyness.

Secondly, we take the plate out of the developer (always holding it by its opposite edges, and look *through* it towards the lamp, bringing it about 6 to 12 inches away from the lamp. We now easily see the various details of the subject—reversed as regards light and shade of course—in all parts except the darkest parts of the negative, *i.e.*, the high lights of nature. But even here we ought to see slight differences, or degrees of darkness.

Thirdly, if we look *at* the back or glass side of the negative we shall just be able to see a slight indication of darkening where the high lights of nature come.

In practice one gets into the way of blending all these three inspections into one general impression, and then deducing whether the plate has been sufficiently developed. But in your case I suggest your being chiefly guided by timing the operation with your watch as already indicated—yet looking at

the plate in all these three ways at the end of the assigned time.

The developing solution is now thrown away and the dish filled up with clean cold water. The dish is rocked once or twice each way and then the plate is put into the fixing bath, and enough of your fixing bath solution poured in so as to cover the plate to a depth of say half an inch.

We now rock this dish every half minute or so to assist its action. If at the end of a minute you examine the plate you will find the milky white part is being dissolved, leaving only the dark (developed parts). For the first plate it will be useful to note the time when the plate first goes into the fixing bath and again note the time when all the milky white "emulsion" has been dissolved out. Let us suppose this takes six minutes, we now allow the plate another six minutes, *i.e.*, 12 minutes in all in the fixing bath, for it is not thoroughly fixed as soon as the white appearance has become invisible. Timing this first plate in the fixing bath will be a useful guide as to how long to allow other plates. Extra time, say 20 minutes, in the

fixing bath will do no harm, nor will it do any good.

The plate may now be taken out, rinsed a moment in clean water and examined in day or any kind of light, for there is now nothing left which is sensitive to light.

Washing the Negative. This may most conveniently be done in some form of washing tank. Of these there are several excellent kinds on the market at quite reasonable prices. We may reckon that a negative should be thoroughly washed in half an hour in a steadily flowing stream in a washing tank.

Drying the Negative. After washing, the plate is removed and held vertically in the fingers and shaken once or twice to get rid of some of the clinging water, then put in a drying rack in a safe, airy place, not too warm and away from dust. The plate must not be dried by holding it in front of the fire or it may melt and be ruined.

A very good place for drying plates is the kitchen mantlepiece, where they may be left all night and will be found quite dry by morning. Or the rack may be placed on a table in front of a partly open window where

there is a gentle draught, but this may also blow a lot of undesirable dust on to the plate, which probably will stick to the gelatine or film-coated side. When a plate is about half dry you will notice a raised edge separating the quite dry part from the half dry and still partly swelled gelatine part. As the plate dries this line travels along and vanishes. Care must be taken not to touch the half dry film or a finger mark will be made.

Making a Trial Print. Let us begin our printing experiments in the simplest way possible, viz., by using Printing Out Paper, or as it was usually abbreviated to "P.O.P." "Printing out" means that the picture slowly becomes visible as printing proceeds, and so is different from the image of the negative which had to be developed.

Note that there are two kinds of P.O.P. on the market. The first introduced requires—(1) washing, (2) toning, (3) washing, (4) fixing, (5) washing, *i.e.*, five operations. The newer introduction known as "Self-toning" is much simpler to worker, as it goes straight into a bath which tones and fixes it at the same time, and then merely requires washing so that the above

five operations are thus reduced to (1) toning and fixing, (2) washing. This also reduces the number of chemicals in the dark room. Note also that you can buy the paper in packets all ready cut up to fit the sizes of your negative, and this saves wastage.

Note once more that P.O.P., both of ordinary and of self-toning kinds is made with a "glossy" and also a "matt" or slightly rough surface. To begin with I advise your selecting the glossy kind.

We require a "printing frame" to hold the negative and paper in close contact during the printing. This bit of apparatus takes various forms at various prices, but the old hinged back form (which costs about 6d.) is all you need have to begin with at any rate.

Lay the printing frame face down on the table, turn aside the two springs, and remove the "back." Now lay your dried negative in the "rebate" or grove of the frame and see that it rests there evenly without any rocking when you alternately touch opposite corners of the printing frame. For if this be not the case the negative will be subject to uneven pressure when the back is put in and

the negative may be broken. (It will therefore be cheaper to give 6d. for a new and true frame than 3d. for a second-hand one that is warped and will break your negative). Be careful to put the negative in the frame with its glass side down, *i.e.*, film side up. Now open your packet of P.O.P. at one end in such a way that you can still use the covering envelope as a wrapper, and take out one piece of paper. A glance shows the difference between the smooth, coated, or sensitive side and the back of the paper. [Note that the sensitive side tends to curl inwards and lay up that little fact as it will come in useful hereafter.]

Now, although P.O.P. is not nearly so sensitive to light as a dry plate is, yet we must not forget that it is sensitive or it would not print, and consequently we must avoid exposing it to daylight as much as we can, *e.g.*, by opening the packet, filling the printing frame, and so on, not in strong daylight but in a shady part of the room.

We now lay the sensitive side of the paper in contact with the film side of the negative. (This applies to all kinds of printing papers).

Then put in the hinged back. Feel that it fits easily without any rocking as before described, and gently close the printing frame.

Then put the printing frame on the window sill or other safe place where it can get the full light of the sky, but not in the direct light of a shining sun.

In five or ten minutes you can examine the progress of affairs by freeing *one* spring at the back of the frame, bending back half of the hinged back, and lifting up that end of the print, while the other spring holds the other half in contact with the covered part of the negative; but always be careful to close up one spring over the back before attempting to set free the other spring; for if once you get the paper out of register with the negative it is a hundred to one that you cannot get it exactly in the right position again, so your paper and your trouble are thrown away.

You will of course have found a leaflet of printing instructions in the packet of P.O.P. This must be carefully read and its instructions followed.

With most, but not every kind of self-toning paper it is necessary to carry on printing until

the picture is *considerably* darker than the finished print is required to be because the toning and fixing makes it much lighter again. Exactly how much extra printing is required can only be learned by experience and cannot be put into words. It also varies with different brands of papers.

The toning-fixing bath is made by dissolving hypo in water. (See paper of instructions for quantities). You have already learnt that dissolving hypo cools the water, therefore, as before, we begin with tepid water, or the toning bath will be too cold.

Of course you will not attempt to tone your print in the same lot of hypo solution that you have used for fixing your negative, or stains and other troubles are likely to arise.

Under, Correct, or Over Exposure? This is the first serious question which faces the photographer after developing and printing his first negative. It goes without saying that if at this point he can have five minutes advice from one who *really* knows the signs of a faulty negative the tyro will learn far more and better than from a written description.

But if he has to plod along without personal and verbal help, I will do my best to help him.

First of all we must always remember that the negative is only a means to an end, and that an attractive looking negative does not always give a satisfactory print—also we shall find as we go along that some of our best prints will be made by negatives that did not look very promising at first glance. For this reason then I advise the beginner to base his experience on the negative, *plus* the print.

So far we have only made one negative and one print, so that we must not attempt to generalise from such a limited experience. It will be advisable to examine the print and negative side by side so as to try to get clearly into our mind and eye-memory the fundamental idea, *viz.*, that the print depends upon different parts of a negative printing at *different rates*, so that by the time the thinnest part has printed very dark, the medium density parts have printed a medium shade, and the densest parts printed but very little. That is the foundation stone upon which all photographic printing rests, and therefore it should be *quite* clear before we go any further.

But suppose in the negative the print is too dark in all parts, or that there is not enough difference of light and shade. What then? Clearly there is not enough difference in the negative. This means (as we shall shortly see) either over exposure, or under development, or perhaps "a bit of both."

On the other hand, if our print is too black and white, *i.e.*, very dark in a few parts, and white paper in other parts, with too little half tones, clearly there is too much difference in the negative. Probably the negative shows almost clear glass in the dark printing parts, while you can hardly see any light through the other parts. This we shall learn is due to either under exposure, or over development, or again perhaps "a bit of both."

Where are we now? In doubt as to whether the fault is due to faulty exposure or faulty development. We must, therefore, learn to separate these faults.

High Lights and Shadows. The beginner is often a little confused when he hears some one talking about high lights and shadows. When the speaker says high lights, does he refer to the lightest part, clearest part of the

negative, or the lightest part of the print? Are the shadows the dark parts of the picture or the densest parts of the negative? Once for all let the beginner understand that when photographers speak of high light they refer to the lightest parts of the original subject, *e.g.*, the sky in a landscape, the white collar in a man's portrait. The high lights of the subject are the lightest parts of the print and the densest parts of the negative. Similarly the shadows are the darker parts of the original and of the print and the most transparent parts of the negative.)

Some Test Exposures. The quickest way to learn these lessons is to make a few tests both in exposure and in development. This work means using a few plates. Do not think this is *wasting* plates, for 6d. properly spent in this way will save you this sum many a score times over.

From a long and varied experience I can say that the chief reason why so many fellows take up photography enthusiastically and soon give it up as "so expensive" is just because they start off by snap-shotting this, that, and the other thing in an utterly reckless

manner "on chance" of hitting a bull's eye sometimes, and of course the result is far more failures than successes. The secret of successful photography is "slow and sure at first."

Now let us select a test subject with some care, so that it includes something light, something dark , and something midway between light and dark. For example a white-washed cottage, an open doorway through which we can just see some of the furniture inside the building, and a grey thatched roof, say ten or fifteen yards away.

If you cannot include all the cottage on the ground glass then arrange to include the open door and dark interior, a part of the white-washed walls, and some of the grey or brown roof.

Whether the sun is shining or not select a position so that the sun is to your right or left and not behind or facing your lens.

Before making the exposure have a good look at the subject so that afterwards when looking at the prints you will be able to compare their light and shades with the light and shades of the cottage.

Focus your Subject so as to get the best general definition with stop F/8. Suppose the light to be bright, but not necessarily sunshine. Now let us use three plates, giving each a different exposure. To the first we give 1-100th second. We now move our tripod a little bit (*i.e.*, a foot or two) to one side so as to get a slightly different view, so that we may know afterwards which plate was No. 1 and which No. 2. Then give the second plate 1-5th second, *i.e.*, twenty times as long as No. 1. Again move the tripod a trifle to the opposite side and give the third twenty times as much as No. 2, viz., 4 seconds.

Now in order to find out what differences the short, medium, and long exposures have made we must develope all three exposures for the same length of time, either all together in a whole plate dish or one after the other, using fresh solutions for each plate and giving each just the same length of time in the developer.

Let us use Rodinal 25 minims per oz. water, and develope each plate for five minutes. (If the weather be cold we had better prolong the development to six and a-half or seven

minutes). Now take three printing frames, put a negative and piece of P.O.P. in each, and put them all out to print in good, bright light, but not in direct sunshine, and print them all for the same length of time with the idea of getting the best results from the lot, *i.e.*, taken as a whole.

I think I can make a fairly good guess as to what will happen.

In No. 1 (*i.e.*, 1-100th second exposure) the white-washed wall part may show something like what you want, but the dark interior through the open door being much under exposed will be something like bare glass on the negative, and print a patch of meaningless dark. No. 3 (*i.e.*, 4 seconds exposure) is probably considerably over-exposed, and the resulting picture shows insufficient contrast—although very likely it gives a lot of detail of what is seen through the open door.

No. 2 (*i.e.*, 1-10th second exposure) probably is the best of the three—all things considered—but possibly the white walls do not show as much light and shade as you would wish, while the details of the interior do not show as much variety as in No. 3.

If we glance at the Negatives probably what we see is this. No. 1, bare glass or something like it in most parts except the white walls. No. 3, plenty of detail in all parts, but the negative looks flat, lacking in light and shade contrast, no bare glass and no strong deposit. No. 2 is intermediate in character and shows the greatest variety.

We now know the general effect of under, over, and medium exposure, with the same development.

For our next trial we move the camera a little further away so as to get the cottage on a rather smaller scale and perhaps include one or two of the surrounding features, *e.g.*, a shrub, bit of garden, or roadway, but still we require our white walls, dark interior, and gray brown roof as our three measuring points.

Now take three more plates and give them each 1-10th second exposure with F/8 as before.

We then see what happens by giving different times of development and the same exposure.

The first we develope for half the usual time, say two and a-half minutes, the second is developed for five minutes, and we develop

for fully ten minutes and a few extra minutes if our patience will last out. The most convenient plan is to start all three plates in a whole plate dish, using 4 oz. of developer, *i.e.*, 100 minims of Rodinal, plus 4 oz. water. At the end of two and a-half minutes take out No. 1 and put it straight into the fixing bath; after two and a-half minutes more take out No. 2 which has by this time had five minutes, and then after another five (or seven) minutes take out No. 3 which has had ten (or twelve) minutes. After fixing, washing, and drying print all three. Now this time we shall not give them the same printing time, but try and get the best result from each one. No. 1 will print fairly quickly, and give a somewhat soft contrast result, probably being too dark in the shadow parts by the time we get gradation in the high lights. But as regards the Nos. 2 and 3, *i.e.*, five and ten minutes development we shall find not *very* much difference except that the longer developed plates take longer time to print to get the best result. But both these two latter ones will show brighter and better results than No. 1.

In fact we can say that with correct exposure the duration of development does not make *very* much difference to the print, but what difference there is, is chiefly a difference of contrasts, *i.e.*, prolonged development gives more light and shade contrast.

With under exposure this effect is more marked. With over exposure it is not so much marked.

Now here is a table which will give you the gist of the matter at a glance, and probably you will find it useful to copy this out on a card and keep it handy for reference in your dark-room.

Under Exposure and Brief Development. No detail in shadows. Thin negative.

Under Exposure and Prolonged Development. No detail in shadows. Strong contrast negative.

Over Exposure and Brief Development. Full detail in all parts. Poor contrast.

Over Exposure and Prolonged Development. Full detail and still poor contrasts, but rather more contrast than the last case.

A Few Simple Words about Lenses. There is a good deal of needless mystery made about

lenses. So far as the every day photographer is concerned the matter is simple enough, although like other things there are countless interesting matters to be found out by those who have time and ability for such studies.

First Experiment. Let us take in one hand an ordinary magnifying lens such as a hand reading glass and in the other a half sheet of note paper. Go into any fairly large room and take up your position against the wall opposite the window. Hold your white paper flat against the wall with one hand and with the other *slowly* move the lens away from the paper towards the window. At a certain position of the lens (depending upon the curvature of its surface) you will get an *inverted* picture or image of the window sharply defined on the white paper, but a slight movement of the lens towards or from the paper puts the image out of focus. This is just what happens when "focussing" a picture on the ground glass of a camera.

Now take any other magnifying lens and you will probably find that the distance between the paper and the lens is different when the picture is sharply focussed to what

it was with the first lens. In that case we should say they had different focal length, or as it is more commonly but wrongly put they have not the same focus.

Second Experiment. Instead of a near object like the window let us open the window and focus for a distant object, *e.g.*, a tree, house, &c., say twenty yards away. The further away the better. If now we measure the distance between the sharp image and a certain point in the lens (which we may here assume is in the centre of the glass) we get the "focal length" or commonly the "focus" of the lens.

Third Experiment. Suppose now we have two lenses of different focal lengths, which by way of example we will imagine are six and nine inches, *i.e.*, one half as long again as the other. We shall observe an important difference in the images they give, viz., that the longer focal length gives us the larger image, and if we measure the images carefully we shall find that one is one and a-half times as long, and one and a-half times as wide as the other. In other words the linear dimensions of the images vary in proportion with the focal

length of the lens—or a lens of 12 inches focal length would give us an image twice as long and twice as wide, or four times the area of the image given by a lens of 6 inches focal length.

Now I imagine "I hear the reader saying to himself, I want to get big pictures and therefore shall go in for a long focus lens." But wait a moment. Did you not notice that with your 9-inch lens just now, that 9 inches from lens to paper means 9 inches from one end of the camera to the other? So far so good. But now let us try another experiment.

Fourth Experiment. Suppose in the last experiment that you were 8 yards away from the window, when the first lens was 6 inches from the paper to give a sharpe image. Now move up a little way towards the window, say a couple of yards, and try again. You will now find that your 6-inch distance has to be increased. Also you will find that for every yard you go nearer the window the more you must increase the distance between the paper and lens to get a sharp image. Now suppose that the limit of your camera length is 9 inches. For distant objects you can use a

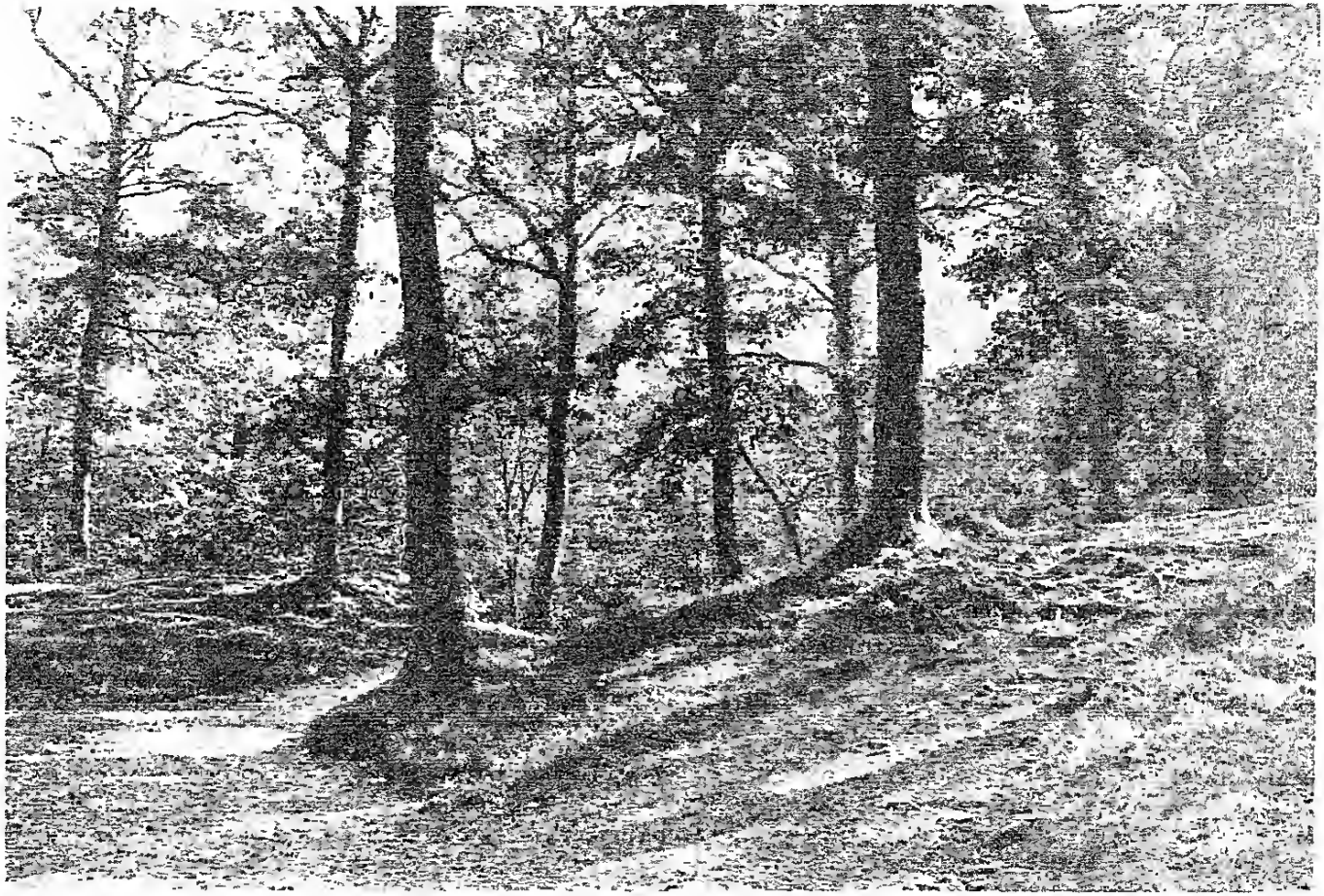


Fig. 16 Bromide Printing. (See page 123.)

Fig. 17. Seaside – General View. (See page 199)

9-inch focus lens, but for anything nearer your lens is put out of action. Moreover, while the 6-inch lens is usable up to a close range, yet even that would not permit us to go nearer than 18 inches to an object and get it in focus with a 6-inch lens 9 inches away from the plate. Thus we see the utility of having plenty of focussing range (long camera bellows). Also we see that the focal length of the lens must be suitable to the camera extension length.

Fifth Experiment. We now come to a very common misunderstanding with beginners as to size of plate and size of image or picture An experiment will make this clear. Let us go back to our 6-inch and 9-inch lens. We pin up our white paper focussing screen flat against the wall opposite the window. With the 6-inch lens focus a picture of the window, and mark the limits of the window frame picture with a pencil on the white paper. Now take the 9-inch lens and again get a sharp picture and also mark its outlines on the paper. In an instant we can see that it is not possible to make the large scale picture come within the limits of the small scale

picture. Yet many a time I have been asked how it is that when using a long focus lens on a camera the user could not get as much picture matter in his ground glass as he did with a lens of shorter focal length. It is a case of you can't have your cake and eat it, or you cannot increase the scale of your picture and include as much of it on the same space as you did before you increased the scale.

Three Kinds of Stops or Diaphragms. The first, *i.e.*, oldest form of a stop was a plate of metal with a central aperture which was a fixture on the lens. Properly speaking the opaque metal is the stop—stopping the light, while the diaphragm is the hole permitting the light to pass through, but nowadays the two terms are used indiscriminately. Having found need to change from one stop to another the fixed plate was abandoned and a slit cut in the lens tube permitting different stops to be inserted in the slit. These are known as Waterhouse diaphragms. But as these were liable to get lost someone hit on the idea of a rotating disc of metal with different-sized holes cut in it, each of which on turning could be brought in front of the centre of the lens.

This is called the rotating diaphragm system Last and best of all some one thought of making an arrangement of metal plates which could be so moved by means of a ring round the lens tube so as to give a large or small opening at will in a way comparable to the opening and closing of the iris in the eye. Hence this form is known as an iris diaphragm.

Stop Numbers. If the reader will examine the stops of his lens he will probably find them marked with numbers, such as 8, 11, 16, or perhaps F/8, F/11, F/16. If the camera is of English make these numbers mean the same thing, but in the case of some American lenses they *may not* mean the same thing. These numbers refer to the diameter of the opening of the stop when compared with the focal length of the lens. (That is to say the distance between the centre of the lens and ground glass when the lens is "in focus" (for distant objects). By way of example let us suppose the focal length to be 8 inches, and the diameter of the stop to be 1 inch, *i.e.*, one-eighth of the focal length. Then that stop may be marked either F/8, 1/8, or simply 8. But all three systems of markings mean

the same thing. Another stop having ½-inch diameter opening would be marked F/16, *i.e.*, one-sixteenth of the focal length, viz., 8 inches. Now a circular opening 1 inch in diameter admits four times as much light as a circular opening half an inch diameter. Hence the ½-inch stop would require four times as long time of exposure as the 1-inch stop to give the same light effect on the plate.

Relative Time Value of Stops. If we know the F/ number of any two or more stops it is an easy matter to compare their equivalent time values. This we do by squaring the F numbers. Suppose three stops to be marked F/6, F/8, and F/11. Squaring 6, 8, and 11 we get 36, 64, and 121. These are nearly in the ratio of 1, 2, and 4, so that practically we could say that F/8 required double the exposure with F/11, or half that with F/6.

It is customary to arrange the sizes of stops of any lens so that the time values are such that the time value of each stop is half or double that of the next one. I give the usual F numbers and corresponding proportional exposures.

F/4, F/5·6, F/8, F/11·2, F/16, F/22·4, F/32,
1 2 4 8 16 32 64

F/45, F/64.
128 256

Some time ago the Royal Photographic Society adopted F/4 as the starting point, and called this No. 1, and F/5·6 as No. 2, and so on. This system is now known as the U.S. or Universal System, and has the advantage of giving numbers to stops which also tell us their relative equivalent time values.

Actinometers are instruments for measuring the photographic activity of the light. As a general rule this is done by allowing light to fall upon specially-prepared paper which at first is very nearly white, but in strong light changes to a violet-grey tinge in a few seconds. The light is measured by counting the number of seconds or minutes which elapse between first exposing the paper and the time when the changing paper just matches a standard tint which is painted along side the changing paper for ready comparison. When one small patch of the sensitive paper has thus been used a disc is rotated which brings another unexposed portion into position for use. The

number of seconds thus counted is often referred to as the "actinometer time" of the light. See also note on the Acto-Midg, p. 17; also see Fig. 13, p. 40.

H and D Numbers. In order to give some definite ideas as to the relative speed or sensitiveness to different plates Messrs. Hurter and Driffield, two eminent scientific specialists, devised an ingenious system of testing and numbering the speed of plates. Many plate makers now adopt this system of speed marking. These numbers are often referred to as the H. and D. speed numbers.

Suppose that under a certain set of conditions one second exposure was required with a plate marked 100. Then with a 200-speed plate only half a second would be required. With a 300-speed plate one-third of a second would be required, but with a 50-speed plate two seconds would be required. Now observe that in all the above cases if we multiply the exposure by the speed the result is the same.

This hint gives us the clue to finding out equivalent exposures with different speeds of

plates. For example, suppose we know that five seconds is correct exposure with a plate marked 60 H. and D., what is the equivalent exposure with a plate marked 100 H. and D. ? Multiplying 60 by 5 we get 300. If now we divide 300 by 100 we get 3. For 60 multiplied by 5 is the same as 100 multiplied by 3, or the same as a plate of 150 H. and D. and two seconds exposure, or a plate of 300 H. and D. speed and one second.

To put the rule into words we may say. Multiply the first plate speed by its exposure and divide this by the second plate speed to find the second exposure.

Practical Test of a Lens. An exhaustive test of a lens is beyond the range of an average amateur, but anyone can make the following test which meets all practical requirements. Against a flat vertical wall which is evenly lighted (indoors or outdoors) fix up two or three sheets of boldly-printed matter such as the advertisement pages of a newspaper. Set the camera opposite this so that the lens is pointed *exactly* opposite the centre of your test object. See that the focussing screen is truly vertical and therefore parallel to the

wall covered with printed matter. Use the largest stop of the lens. Focus for the centre of the ground glass, and compare the definition with that towards the corner of the ground glass. If they are the same the lens has a "flat field." If this is not the case you will have to alter the position of the ground glass by means of the focussing screw to get the corners sharp. In many good lenses the field is not quite flat and in practice this does not matter if it be only slight. But the difference should not be very great. Next take a bit of thick white cotton, hang a small heavy object to it, say a key, and then place it against the wall in such a position that its image comes about $\frac{1}{8}$-inch away from the edge of the ground glass. The key will make the cotton hang straight down. If your lens is Rectilinear it will show this straight (cotton) line as a truly straight line on the ground glass. By bringing it fairly near (*e.g.*, $\frac{1}{8}$-inch) the edge of the ground glass—which itself must of course be truly vertical—you will be able to see if it is straight or slightly curved.

Now on a bit of white card, *e.g.*, a post card, rule two or three quite straight ink lines,

about one inch apart, and then when these are dry rule other lines crossing these at right angles. Then fasten the test card flat against the wall so that its image comes near the corner of the ground glass, and examine carefully to see if the horizontal and vertical lines look equally sharp at the same time. If the lens is not free from astigmatism you will find that while you can get the vertical lines also the horizontal lines both sharp by turning the focussing screw this way and that, yet you do not get them both quite sharp at the same instant. A lens corrected for this defect is said to be free from astigmatism or is stigmatic, holostigmatic, isostigmatic, orthostigmatic, and so on, all meaning the same thing.

Finally we focus with the largest stop for some small type which comes near about the centre of the plate as sharply as possible, and then expose and develope a plate, fix, wash, and examine it. If the negative is not as sharp as the ground glass picture then the lens probably suffers from chromatic aberration, in other words is not achromatic.

But as a mater of fact in these days it would

be difficult to find a lens sold by any respectable firm for photography, even in the quite low-priced camera, that is not corrected for colour aberration so that practically this defect does not exist nowadays.

Why do Photographic Lenses Cost so Much is often asked by those who do not know the enormous amount of skill required for the making. But when once we know something about the optician's problems the question becomes, how can they be made for so little ?

You can buy a hand magnifying glass for a shilling or so, and wonder why you cannot put that in a brass tube and use it to take photographs. So you can, but what are your photographs like.

First of all you would focus your picture as best you could, and then on developing find the negative out of focus. This is due to the fact that the visible image of such a lens does not correspond with the chemical or photographic image due to the different colour rays forming white light not all coming to the same focus. This defect is called " chromatic " or colour aberration. To prevent this a lens is built up out of two different pieces of glass

of different kinds made to fit each other perfectly. Such a colour-corrected lens is called "achromatic." Next you would find straight lines coming near the margins of your picture shown as curved lines. This defect is called "distortion." To make a long story short, there are some five or six defects or aberrations which such a lens as a reading glass would give. To meet these means a lot of mathematical calculations in the first place, and then highly skilled workmanship to carry them out. Hence a high-class lens costs something in wages to make.

Narrow and Wide Angle Lenses, Angle of View, &c., and View Meter. This is often rather a puzzling topic to the beginner, but the following very simple experiment will make it clear once for all. Take any short piece of card about 8 × 6 inches in size, and at the centre cut out a rectangular opening 4 × 3 inches, or just the picture size given by a quarter-plate negative. Now take a tape measure marked in inches and hold one end of it just under one eye (closing the other eye), slip the tape measure through the hole in the card and then with the other hand hold the

tape and card so that the opening in the card is exactly opposite the open eye and is just 4 inches from the eye. On looking through the opening we shall see how much picture subject a 4-inch focus lens would give us on a quarter-plate. Similarly by increasing the distance between the eye and opening to 6 inches we get what a lens of 6-inches focal length would give us. Similarly with lenses of any other focal length.

The nearer the opening is to the eye, in other words, the shorter the focal length of lens, the nearer it is to the plate and the more subject we can see or get on our plate; or again, in other words, the wider the angle of view. On the other hand the longer the focal length of lens the less we include, but obviously it is on a correspondingly larger scale.

View Meter. Let us suppose that we are chiefly interested in landscape subjects, and that we sometimes include objects as near as 20 yards from the camera, but that more frequently the nearest part of our picture is rather further away than this. Set up your camera and focus any object at 20 yards

distance. Then measure the distance between the centre of the ground glass (or the front plate in a magazine camera) and the stop inside the lens. Although this distance will not be the true focal length of the lens it will be the effective and practical focal length for your everyday work. Let us suppose this is 6 inches. If now you fix to your card with the 4 × 3 opening in it a bit of tape 6 inches long and sew a small ring on the other end of the tape you have a practical view meter. By holding one end of the tape just below the eye with one hand, and keeping the tape tight with the other hand, you will then see how much picture material your plate will take in. This useful little contrivance will thus save you the trouble of fixing up your camera when in doubt as to whether you can include a certain view on the plate from any selected position.

It is also useful when looking about for pleasing compositions, as it cuts off the view from surrounding objects. Of course when making such a view meter for the pocket you will not use a card 8 × 6. If tough and stout card be used it will suffice if the outside

masures 5 × 4 and the hole 4 × 3, thus giving a marginal width of half an inch all the way round.

Types of Shutters. Perhaps the earliest form of quick acting shutter was that known as a *drop shutter*. This consisted of a thin flat piece of wood, say 9 inches long and 3 inches wide, with a hole in it about the same size as the lens hood. This piece of wood was cut so as to slide easily in another piece fitted to the front of the lens. As the sliding part fell down in its groove the opening passed in front of the lens and made the exposure. A very similar idea is still in general use, but here the dropping part is replaced by a flat thin piece of metal with a hole cut in it and pivoted so that it rotates in front of the lens, being actuated by an elastic band or metal spring. Instead of the wood dropping past the front of the lens let us suppose we have an opaque curtain of flexible material like rubber cloth, and arrange it to wind off one roller or spool on to another roller. We can actuate it by winding up a spring connected with one of the rollers. If now we cut a suitably shaped hole in this curtain this hole

passing in front of the lens will give us an exposure. Hence the *roller blind shutter*, generally used in front of a lens.

Instead of putting such a roller blind shutter in front or behind the lens, we put it close in front of the plate, the same thing happens, but with slightly different results, which we need not now stop to discuss. We then have a *focal plane shutter*.

There is yet another blind shutter, seldom seen now, yet it possesses some exceedingly valuable properties for landscape work. This consists of a long straight piece of material, say 12 × 3 inches, without any hole cut in it. It simply hangs over and rests on one roller above the lens, by pulling a string attached to one end of the material this end comes down and draws up the other end. Thus the lower part of the lens is first uncovered, and is again the last to be covered, so giving the foreground part of the picture the advantage of a longer exposure.

We now pass to an entirely different principle. Suppose we have a circular plate of metal just fitting the lens tube, and that we cut it in half, and by suitable mechanism

make the two halves to move away from each other and then come together again. In this way the centre of the lens would be the first to admit light and the last part to be closed. If now we go a step further and cut our disc not into two, but into several parts, and make each part recede from the centre and then return we should get a shutter opening and closing centrally.

There are various modifications of this leading idea employed as *between-lens shutters*, and for the most part they are marvels of excellent workmanship and cheapness, considering the difficulties of manufacture.

Being made of metal they do not warp like wood, or perish like some of the flexible materials do, and being enclosed between the lenses they are kept guarded from moisture and dust if reasonable care be exercised.

In all forms of shutters either in front of or between the lenses *some* time must elapse between the beginning of the action and the full opening of the lens, similarly some similar time must be taken up by the closing action. For instance suppose the shutter be set for *one* second and that it takes 1-10th of a second

to open the lens fully, and a similar time to close it again; then obviously the shutter is only fully open 8-10ths of the second and partly open during 2-10ths of the second.

The shorter the relative time taken in opening and closing the shutter the higher is "efficiency." Different types of shutters vary considerably in their efficiency. The "focal plane" is the form giving us the highest efficiency, and hence its favour with those who are attracted by high speed work, *e.g.*, express trains, racing, jumping horses, divers, &c.

Shutter Speeds. The amount of light passing through the lens during the shutter exposure depends upon various factors. In "focal plane" shutters we can alter the *width* of the slit which passes in front of the plate, and also alter the rate at which the *slit* passes from one side to the other by altering the spring tension, and thus get a considerable range of exposure, from perhaps one second to one-thousandth part of a second. In "roller blind" shutters we can also alter the speed of travel by spring tension. In "between lens" shutters also the speed of opening and closing is under control

either by springs or air valves. Then again by altering the size of stop or diaphragm the amount of light passing through the lens is altered.

Thermometer. There are two pieces of apparatus, both of which may be bought for quite small sums, and yet the beginner thinks he can quite well do without them and spends the money which would buy them on something not nearly so useful.

The first of these is a thermometer for ascertaining the temperature of a liquid. The other is a balance or pair of scales for weighing small quantities of solids.

First as to the Thermometer. One can buy a cheap form for about a shilling, which is quite accurate enough for our purpose. When not in use this should be hung up by a loop of stout string to a nail in the wall. Many people think they can tell by "the feel" how warm a thing is, but any one who once makes the following experiment will see how foolish this really is. In three milk basins or other convenient vessels put cold, warm, and hot water respectively. Now put one hand

in the cold and the other in the hot water, and keep them there for a few minutes. Then put both hands into the warm water. The hand from the cold basin will feel the warm water to be much warmer than it is, while the hand from the hot water will feel the warm water to be much colder than it is. It is quite a curious sensation to *see* one's two hands in the same lot of water and yet feel two very different temperatures. The cost of the thermometer will quickly be repaid in the saving of spoiled plates and prints due to using solutions too hot or too cold.

Standard Temperatures. Broadly put we may say that the standard temperature range for nearly all photographic operations is 60°—70°F. (or Fahrenheit), or say 15° to 21° on the centigrade scale. In exceptional cases such as development of carbon or platinotype prints we employ much higher temperatures, *e.g.*, 100°—110°F. for carbon, and 120°—160°F. for hot bath platinotype.

As a rule the warmer a solution is the more energetically it acts—but when dealing with gelatine-coated plates and papers we have to remember that the coating begins to get

dangerously soft a little above 70°F., and frequently melts at about 90°F.

Hypo and Temperature. One common cause of trouble is due to using the fixing bath too cold. If 4 ozs. of hypo crystals be thrown into 20 ozs. of water at 60°F. and gently stirred until the crystals are dissolved it will be found that the mixture is now below 50° and probably about 46° or 48°. This is too cold for general use. Hence warm water is used, say at 75°F. for dissolving hypo for a fixing bath for immediate use so that when the crystals are dissolved the solution is not below 60°F.

Blisters and Frilling of the film are often due to transferring a plate or print from a warm to a cold solution or *vice versa*. Here again comes in the use of a thermometer. Then again some developers are very slow in action if they are too cold.

Balance or Scales. Beginners very naturally prefer to buy their solutions ready made, and just at first this is advisable, as the fewer things we have on hand the better attention we can give to them. But presently we find ready made solutions come rather expensive,

not so much on account of what we use but what we waste. By making up for ourselves many of these things of which we only require a little at a time we can prepare just enough, and no waste; guess work will not do. The difference between 3 pounds and 4 pounds we easily see is one of importance, but do not recognise that it is the same proportional difference as between 3 and 4 grains. When buying a balance it will be advisable to select one with glass pans, as the brass pans are easily corroded by splashes of liquids, while glass pans are easily kept clean if wiped with a bit of rag after each use. Begin by weighing carefully and it will so become a habit, and remember that the permissible error should be proportional to the total weight. For instance, the difference between 10 and 12 grains is the same proportion as between 100 and 120 grains.

When weighing hypo for a fixing bath a quarter of an ounce above or below the 4 ozs. for a pint of water will not very much matter, but there is a very real difference between one and two grains of potassium bromide per oz. of developer in some cases. It is a very good

rule to limit oneself to a 5 per cent. error, *i.e.*, one part in twenty, *i.e.*, if weighing 20 grains the error must not exceed one grain. —one twentieth part of the total weight. This will be found accurate enough for most practical photographic purposes.

Weights. It will be convenient to have a set of grain and dram weights which enable us to weigh up to 4 drams, *i.e.*, half an oz.

For larger quantities in ounces such as hypo the kitchen scales and weights may be made to serve.

Improving a Faulty Negative. The most skilful photographers occasionally make negatives which require after treatment so that the beginner need not be discouraged if his negatives are not perfect. Now as he may go wrong either in exposing or developing it may be well to set down a list of his possible mistakes thus :

Under exposure followed by (1) brief, (2) moderate or, (3) prolonged development. Correct exposure followed by (4) brief, (5) moderate or, (6) prolonged development. Over exposure followed by (7) brief, (8) moderate, or (9) prolonged development.

Thus nine things may happen of which number (5) only is quite satisfactory.

First let it be clearly understood that if the exposure has been much less than what is deemed correct exposure it is a waste of time and trouble to attempt after treatment, because if the image is not present nothing we can do will give satisfaction. So that it will be best to dismiss (1), (2), and (3), as hopeless cases.

Case (4) correct exposure and under development is perhaps the easiest to treat, viz., by moderate intensification. Case (6) similarly requires moderate reduction.

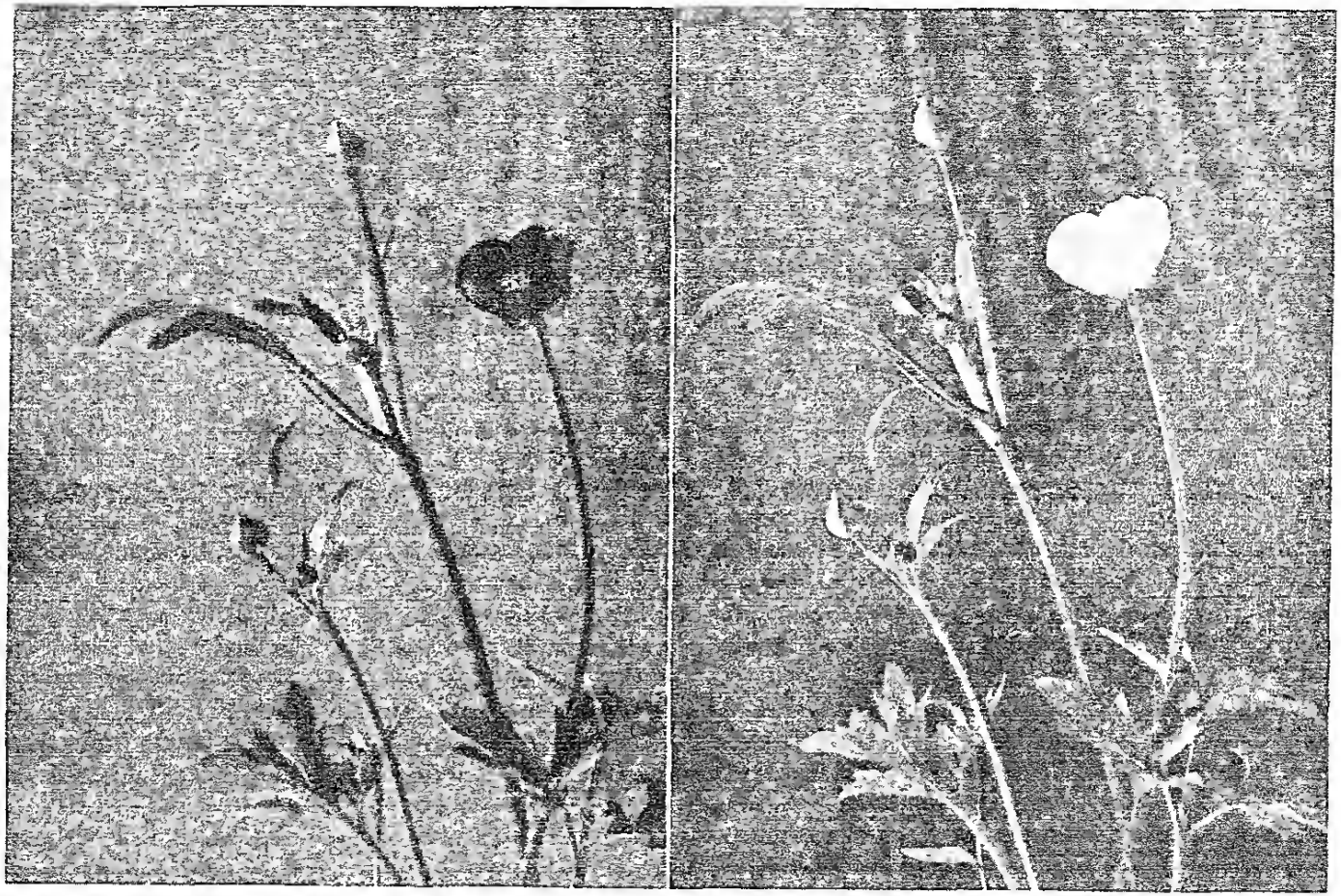
With over exposure in many cases we get a slight veil or layer of fog all over the image, the negative when looked through, giving one the idea that there is a mist or fog between our eyes and the plate. Or we might roughly compare it to a layer of very finely ground glass placed in contact with the negative.

While over exposure (if not excessive) tends to reduce the light and shade contrasts although detail is abundantly present our aim will be to strengthen or intensify these

contrasts. But if the fog veil be serious in amount any intensifying we do will increase the fog as well as the other parts. Therefore we must first try to remove the fog and then strengthen the image. But then again while we are removing the fog the chances are that we are at the same time removing some of the image. If the image be strongly developed we can afford to part with some of it and strengthen what is left, but if it be only slight to start with we may entirely lose the fine details in the thin parts. Consequently both care and judgment are required lest we make matters worse rather than better. What it therefore comes to is this: If fog be present we must not carry the removal of the fog to the point of dissolving away the finer details in the shadows or thinner parts.

Case (7). Over exposure, brief development. Unless the fog is serious in quantity, which happily is seldom the case here, it will be best to ignore the fog rather than risk loss of detail, and rely on intensification only.

Case (8). Over exposure, moderate development. In practice it will frequently be found that a *slight* reduction with the hypo and



A.

Fig. 18. Ordinary Plate.

B.

Ortho. Plate. (See page 198.)

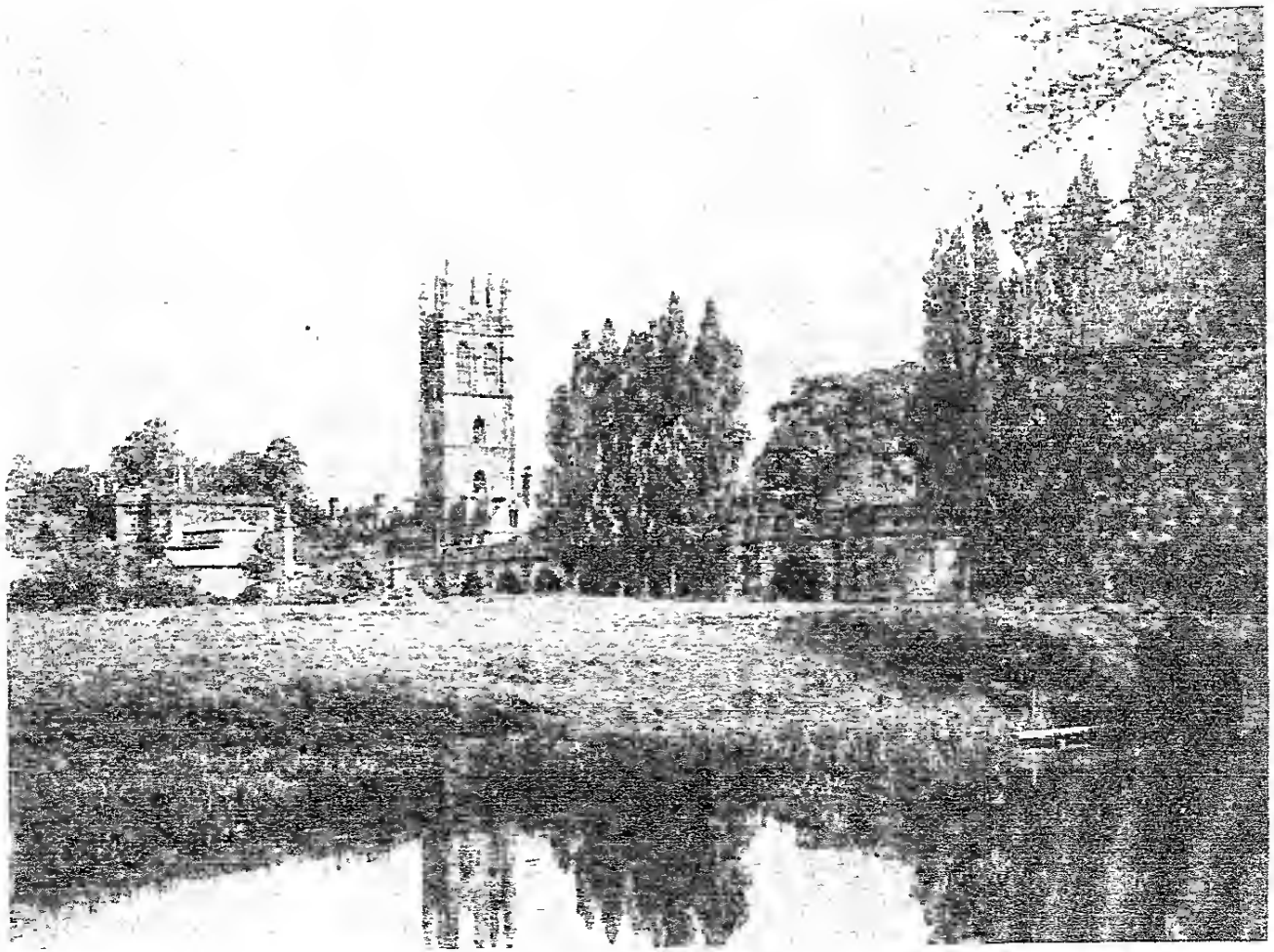


Fig. 19. Riverside Landscape. (See page 200.)

ferricyanide reducer is all that is required, but then as our negative will probably be a little weak in contrasts it will be advisable to print it in a subdued light, such as by placing the negative inside a room facing good sky light, but not in direct sunshine. It will be well to try a print in this way before proceeding further. Then if it is found to lack quite sufficient contrast it may be obtained by bleaching with mercury bichloride and blackening with sodium sulphite.

In Case (9). Over exposure, prolonged development. This will very probably require reduction by hypo and ferricyanide to a considerable degree to get rid of the fog, and as this will have reduced the negative generally we most likely shall have to intensify subsequently.

Now to go back a moment to under exposure. In practice we occasionally get negatives which have not had enough exposure for thoroughly satisfactory results, and yet the shortage of exposure has not been so serious as to render the case quite hopeless. In cases of this kind where we cannot revisit the scene and make a correct exposure we often

can get a negative that will give us a print that is better than no print at all, although it is not quite satisfactory. Cases of this kind are fairly common in hand camera work, where the movement of the object or the dull light did not permit of our giving as much exposure as we knew was desirable.

We have already learned that under exposure tends to accentuate contrasts, and over exposure tends to reduce contrasts also. Development tends the opposite way, viz., under development gives less contrasts than prolonged development produces.

Let us use the term brief exposure to exposure of say half that which we regard as correct exposure.

Brief exposure: under development. Remedy: intensification; with care not to carry intensification too far. The uranian method is suitable as it gives us a good range which can be stopped at any point and if found unsatisfactory it can be easily removed.

Brief exposure: moderate development. Better leave the negative as it is and print on a rough surface paper.

Brief exposure: over development. This is the commonest fault of all with hand camera workers, generally. The best remedy is cautious reduction by the ammonium persulphate method.

Reducing and Intensifying Formulæ. There are dozens of methods which might be mentioned, but to mention more than we really need would confuse rather than help the reader. I have, therefore, thought it best to bring together a few selected methods, giving the special characters of each, so that having carefully diagnosed the disorder, and consequently made up one's mind what to aim at in the remedy we may be able to select the best medicine for each case.

Hypo and Ferricyanide Reducer. Some workers complain that this process yields a stained negative. But I have never found this to result if it be used in the following way. The negative is first placed in a solution of hypo in water, viz., hypo 1 oz., water 4 ozs., which has not been previously used for any purpose. While the plate is soaking in this (for say five minutes) we pick out a crystal of Potassium Ferricyanide about the size of a

large pea or small hazel nut kernel, rinse this under the tap for a second or two, then put it in a 2-oz. graduate, and 2 ozs. of the hypo solution just named. Then with a glass rod stir the crystal round and round (but do *not* try to crush it) until it is about half dissolved, yielding a pale yellow solution. Pour this into a dish, retaining the rest of the crystal in the graduate, transfer the plate from the plain hypo solution to the mixed reducer, rock the dish a few times, and in half a minute take out the negative and examine it. By this time reduction has probably started. Now return the plate to the plain hypo for a half minute. By this time possibly any slight fog veil will have been removed. Examine for this by looking through the negative at a sheet of white paper in a good light—preferably daylight. If the plate is not sufficinetly reduced return it to the reducing bath and repeat the process. If you find the action too slow then return the plate to the hypo and pour the reducer back again into the graduate containing the remainder of the crystal and stir up until more of the crystal is dissolved and again apply it. The

special feature of this method of reduction is that it attacks the shadows or thin parts more than the dense parts, and so is a good fog reducer and also is useful when our aim is the increase of relative contrasts. This reducer should be freshly mixed each time it is required, for it rapidly deteriorates, as may be seen by the way the solution left standing in a dish turns greenish in colour.

Of course the plate requires as much washing after this bath as it does after leaving the hypo fixing bath.

Although I do not advise the beginner attempting any after treatment of a negative until the plate has been printed, yet in time one learns to know by eye examination that a certain treatment is certainly required, so that in those cases which we are sure call for this form of reduction we can commence operations as soon as the negative has been fixed and so save the time and trouble of washing after fixing and subsequent drying

Ammonium Persulphate Reducer. This acts in a different way to the Hypo and Ferricyanide reducer. The ammonium salt reduces the high lights (dense parts) more than the

shadows, and so is of especial value when we want to reduce a negative with too much contrast and yet not lose much of the shadow detail. Hence it is of especial value in the case of either brief or correct exposure, followed by over or prolonged development. It is made by dissolving 10 to 12 grains of the persulphate per oz. of water. If should be used at once as it does not keep satisfactory in simple aqueous solution. When weighing out the required quantity do not leave the cork out of the bottle a moment longer than is necessary, as on exposure to air the salt deliquesces, *i.e.*, absorbs moisture from the air and becomes wet and spoils. When this reducer is applied to the plate the solution soon begins to look a little milky, telling us that action is going on. One must withdraw the plate before the desired action has gone far enough, because the solution absorbed by the gelatine goes on acting for a time. The plate must be free from any trace of hypo or stains will result, and it also requires well washing after reducing.

Mercury Intensification. In spite of the many criticisms which have been given about

this process probably it is more generally used than all the others put together on account of the simplicity of the process. One great objection to it is that the mercury salt is a deadly poison, and therefore it must always be very distinctly labelled in large letters Poison, and also put in a safe place where it cannot be used for any other purpose than photography.

This chemical has four names, viz., Mercuric chloride, Mercury bichloride, Mercury perchloride, and Corrosive sublimate. It is a white heavy finely crystalline substance sold in powder or lumps.

In a 20-oz. bottle put ½-oz. of this salt, viz., mercuric chloride, and fill up the bottle with warm water. When the powder is dissolved then add 20 drops of hydrochloric acid if you have any, but its presence is not essential. A plate put into this water-like solution presently turns gray and then white, and if looked at against a black background often presents a pleasing appearance—and in fact in the early days what were called "alabastrine pictures' were produced by bleaching thus, drying, and backing with black varnish. To return to

our bleached negative we must now wash it very thoroughly for say half an hour in a gently flowing stream, or in numerous changes in a dish with frequent rocking of the dish. It is largely due to imperfect washing at this stage that beginners fail. Patience is the keynote of success here. After thorough washing then place the plate in a dish and pour over it the following mixture, viz., ammonia 10 drops, not more; water 1 oz. The plate now turns black or brownish black, and the contrasts have been considerably strengthened.

If not so much contrast strength is required then in place of ammonia we use the following: Soda sulphite 1 dram, crush to a powder and add 1 oz. water.

After darkening by either the ammonia or the sulphite the plate again requires well washing.

Uranium Intensification. This again has a bad name in some quarters owing to careless use. Nevertheless it is a very useful process for two very practical reasons. First if for any reason it is found unsatisfactory we can easily remove it and bring back our negative

to the starting point, so that if we have done no good we have done no harm. The second reason is that we can get much or little strengthening according as we give the plate a short or long time in the bath.

We require two solutions, viz., A. and B. in separate vessels.

A. Water 4 ozs., Glacial acetic acid 1 dram, Uranium nitrate (or acetate) 30 grains.

B. Water 4 ozs., Glacial acetic acid 1 dram, Potassium ferricyanide 40 grains.

For an intensifying bath mix equal parts of A. and B. In this the plate turns from black to warm purplish black, brown, chocolate, and finally to a sienna red. We must bear in mind that though we can see a red deposit yet the light that passes through it has little or no effect on the printing paper, so that this method partly acts by changing the colour of the negative.

After intensification to the required degree has been obtained the negative is washed in acidulated water, *i.e.*, ten to twenty drops of acetic acid to a pint of water.

If we wish to remove the intensification we merely have to wash the plate in alkaline

water. This is easily obtained by dissolving a saltspoonful of soda carbonate in a pint of water. As tap water is often slightly alkaline, washing in such tap water washes away the intensification. If the high lights are not sufficiently removed by washing in the acidulated water just mentioned we can get our remedy by washing the plate in water 20 ozs., ammonium sulphocyanide 1 dram.

Choice of a Printing Process. It is now time to say something about the various printing processes which are available.

Many a beginner makes the mistake of thinking that there is some very special advantage in a certain developer, plate or printing process. Visiting a photographic exhibition he is captivated by two or three selected pictures, and jumps to the conclusion that their producer has some special apparatus, or uses some special process. But this is nearly always a radical mistake. Some of the best work is turned out by quite cheap and very simple apparatus. It is the man behind the camera that makes the result extra good.

We have now open for our choice quite a

number of printing processes; and by any one of these excellent pictures may be made. Our leading worker pins his faith to this, another to that—which really means that if you select any one of these processes and stick to it perseveringly until you have mastered its possibilities, then you can do nearly anything you like with it.

At the same time it should be understood that each process has its own special qualities, *i.e.*, often a combination of advantages and disadvantages, so that all the eggs are not in one basket.

I propose now to give a brief yet practical working outline of several of the present-day processes, so that the reader may compare one with the other and then make his own choice. After a few preliminary trials he will then be in a position to appreciate more detailed information, which must be sought in one of the various handbooks devoted entirely to that one process.

To save repetition it may be stated that in each of the various processes we may produce variations due to rough or smooth, white or

tinted papers, etc. For these details the several manufacturers' lists should be consulted.

As each paper maker gives a leaflet of definite instructions with the packet of paper, this should always be consulted and followed as closely as possible.

Printing Frames are made in great variety so that each may suit his own fancy. The one thing that is important is that the rebate or groove on which rests the negative must be

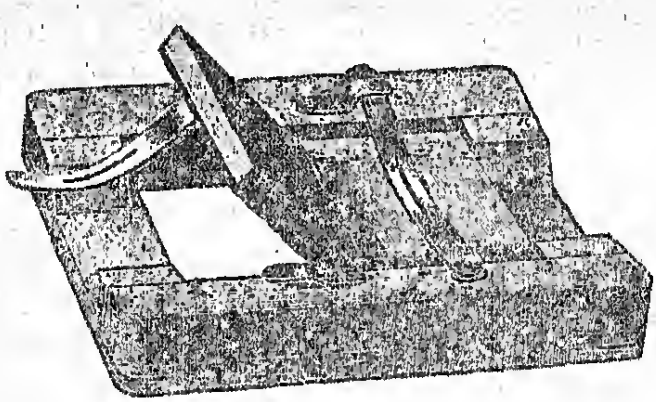


Fig. 20.

quite flat, otherwise the negative may be broken when the frame is closed in consequence of its being subject to unequal pressure. The back is held in place by springs and these should be easily turned on one side so that the progress of printing can be easily examined.

There are various special forms of printing

frames for special kinds of work, but the beginner may be content to work with such a form as here illustrated (Fig. 20).

The beginner is advised to lay the foundation of his printing experience by commencing with self-toning P.O.P.

P.O.P. (Print-out Paper). This is of two kinds, *viz.*, (1) the self-toning, *i.e.*, combined toning and fixing kind.

Self-toning P.O.P. The paper is put in contact with the negative and printed by daylight until the image is considerably darker than the print is required to be when finished. In some cases it is washed, in others it is put straight into a solution of hypo, where fixing and toning go on simultaneously. At normal temperatures this takes perhaps ten minutes. The print is next washed for an hour in running water, then hung up by one corner to dry by passing a steel pin through one corner of a print and then fixing it to the edge of a shelf. It should not be placed between blotting paper to dry, as the coated (picture) side will stick to the blotting paper, but it may be surface-dried by lightly dabbing with a quite clean and dry handkerchief, and then dried by

laying it flat down with the back resting on a couple of thicknesses of blotting paper.

Variations of "tone" (so-called, *i.e.* colour) are obtainable in several brands by bathing the print in salt and water before toning. It is an advantage for the beginner that he can watch the printing and so stop printing at any moment. The paper keeps fairly well for some weeks. The variation of colour are not very great, *i.e.*, warm browns and red browns, sometimes with a yellowish tendency.

P.O.P. Separate Toning and Fixing. This is also a visible printing process. The print must not be quite so darkly printed as in the self-toning process. The print is then washed in several changes of water for, say, ten minutes. It now goes into a toning bath. The formula I find best is: Warm water, 20 ozs.; Solid phosphate, 30 grs.; Gold chloride, 1 gr. Allow this to stand until the thermometer tells you that the temperature is between 60° and 70°F. (see note about gold chloride at end of this section). The colour changes or "toning" proceeds slowly and may occupy five, ten or fifteen minutes. As the print will dry less red and more blue than it is when

taken out of the toning bath we must make due allowance for this by keeping it on the red or warm side of the colour we are aiming at finally. After toning the print is washed for two or three minutes and then fixed for ten minutes in : Water, 20 ozs. ; Hypo, 3 ozs. It is then washed for one hour in running water and dried.

Gold Choride is sold in small glass tubes, containing 15 grains of bright yellow crystals, costing about 1s. 1od. or 2s. per tube. Buy a new narrow mouth 2-oz. glass stoppered bottle. With a three-cornered file make a nick or scratch in the side of the glass tube containing the gold chloride crystals. Then break the tube by gently pressing the side opposite the nick, or if preferred place the tube in a *quite* clean 2-oz. glass measure and squash the tube with the flattened end of a glass rod. Then pour into the measure and broken tube ½ oz. of distilled water. Gently swirl the measure round once or twice, when the yellow crystals will quickly dissolve, giving a bright yellow solution. Put this in the 2-oz. bottle, pour another ½ oz. of distilled water into the measure, swirl round and add

the liquid to the bottle, repeat this twice more and so get out of the broken tube all the gold and leave behind the broken glass tube. You now have 15 grains of gold chloride in 16 drams of water. This you may reckon as practically one grain of gold per one dram of solution. Having our gold in solution it is now easy to use just as many grains as we like, by measuring the solution.

Gelatine and Collodion P.O.P. Perhaps I ought to explain that P.O.P. is made in two different ways. In one the vehicle or matrix for the sensitive silver salts is gelatine, so that this class is sometimes called gelatino-chloride paper. In the other kind collodion is used as the vehicle and hence the name collodio-chloride paper, which is sometimes abbreviated as "C. C."

Broadly put, the manipulations are the same for gelatine as for collodion, but the latter (collodion) papers have one advantage. We can place them to dry between blotting papers—or we can surface dry them with blotting paper, and then dry them by holding them in front of a fire. If we treated a gelatine print in this way it would either stick to the

blotting paper, or probably melt if too near the fire.

Gaslight Papers. As the name indicates, these are papers which can be printed by gaslight, but as they are not nearly so sensitive as bromide plates we do not require a red lamp for the developing room, and, in fact, it is quite customary to use an ordinary (not incandescent) naked gas flame when developing, but this is turned down to a small flame, or we must go to the end of the room opposite to the gas and work in the shade of a screen, or with our backs to the light. When developing we only require just enough light to see what we are doing.

The beginner will be well advised to commence his trials with a packet of glossy surface paper so that there will be no doubt or difficulty in knowing the sensitive (smooth) from the non-sensitive side. Of course the sensitive side is put next the film side of the negative in the printing frame. This should be done as far as convenient from the light, and in the shade of the body.

It will give the reader a good general idea to mention that with a medium density

negative held six inches from a No. 5 Bray's gas burner the exposure would probably be about two minutes, but might be one or four minutes according to the negative, brand of paper and so on.

Printing produces no visible change and the "latent image" has, therefore, to be brought out by development. The following may be regarded as typical: Water, 10 oz.; Soda sulphite, 1 oz.; Metol, 10 grs.; Hydrokinone (Quinol), 30 grs.; Potass. bromide, 3 grs.; soda carbonate, ¾ oz. Dissolve in the order given. This is a one-solution developer which keeps fairly well. It may be used "neat," but if softer results are required it may be diluted with an equal quantity of water.

The developer is poured over the dry paper —after exposure of course. It is important to see that the developing dish is quite clean. The paper must be handled as little as possible, and the front or coated side must not be touched with the fingers or stains, etc., will result. Development is fairly rapid, taking perhaps less than a couple of miuntes. Before the print is quite at the finishing stage it should be taken out and plunged right into a

dish of fixing solution—care being taken to avoid air-bells clinging to either side of the paper. It should be turned over once or twice in the fixing dish. No two prints must be permitted to stick to each other or imperfect fixing and staining will result. Allow a full ten minutes for fixing. Do not let the prints

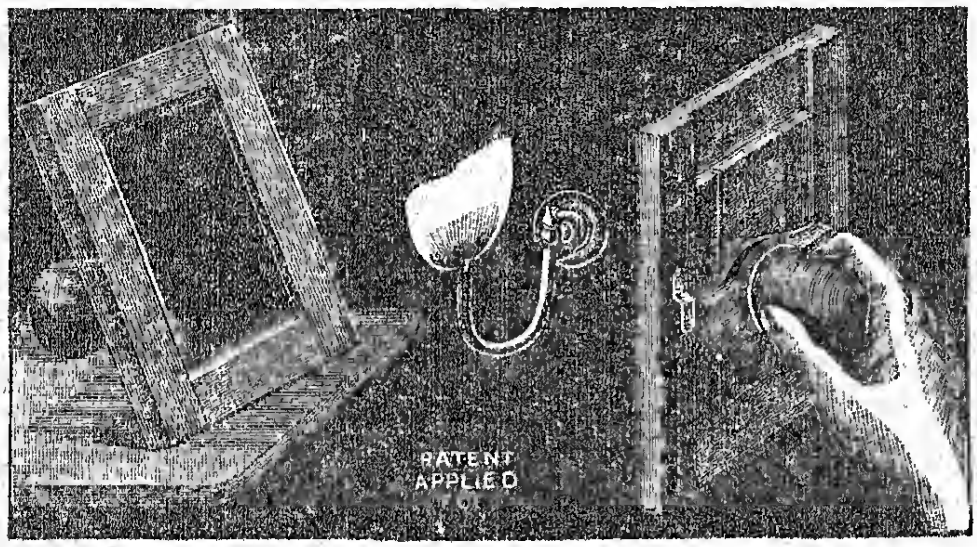


Fig. 21. The "Mecca" Printing Frame.

float face up in the fixing bath, or trouble will ensue. After fixing, the prints require an hour's washing in a gently flowing stream of water.

The resulting prints are black and white, but may be "toned" to various colours.

After washing, they are hung up to dry as described in the note on P.O.P.

Gaslight paper gives us a convenient method of making prints by artificial light in any ordinary room, *i.e.*, not the usual photographic "dark-room."

The figure on preceding page shows a very convenient form of printing frame for gaslight printing, as it enables us to hold the frame at the required distance from the flame without risking shadows, etc., by the fingers being in the way. The handle at the back is very useful when the frame can be laid upon a shelf near the gas bracket. This frame is called The "Mecca."

Although the paper is called gaslight paper yet it can be quite well worked without any gas at all. Printing can be done by a few seconds, exposure to diffused daylight at a north-facing window. Or printing may even more certainly be done by burning a short length, *e.g.*, an inch of magnesium ribbon, at eighteen inches or two feet from the printing frame.

Development can very well be conducted

in the yellow light of a paraffin lamp, or better still by candle light.

Gaslight paper is, therefore, very convenient for the isolated amateur living in a village where gas is not available.

S.C.P. or slow contact paper is another name for gaslight paper.

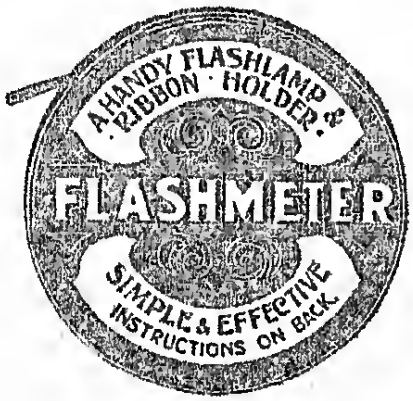


Fig. 22.

The little apparatus here shown is very useful in this connection, for it contains a coil of magnesium ribbon. We can pull out and burn just as much as is required. The case itself forms a handy holder (Fig. 22).

Glossy papers (gaslight and bromide) are apt to show hair-like markings or a grey fog towards the edges of the print. Usually these defects can easily be removed when the

print is *quite* dry. A couple of thicknesses of clean rag are just moistened by a few drops of methylated spirit and then briskly rubbed round and round on the print with a gentle pressure. This has also the effect of brightening the print up generally.

Bromide Printing Papers resemble gaslight printing papers, as regards the general outlines of their procedures, *viz.*, exposing the paper behind a negative in a printing frame, no visible image after printing, development of the image, fixing and washing. But while a gaslight paper requires, let us say, two minutes at six inches from the gas, an ordinary bromide paper would perhaps require only two seconds at this distance. Consequently, while the comparative low sensitiveness of gaslight papers permits of their being developed by means of a naked gas flame, it would be unwise to attempt this with a fifty or sixty times more sensitive bromide paper. Consequently for bromide work we require a lamp with a yellow glass, or what is perhaps more agreeable to the eyes, *viz.*, yellow ("canary") fabric. This gives us plenty of soft, diffused light, which enables us to see what we are doing very much

more easily than is the case when developing rapid plates by the aid of our ruby lamp. I just mentioned an exposure of two seconds at six inches from the gas flame, but that was only a very rough and ready estimate. For, as a matter of practice, it would be very inconvenient and wasteful of material to employ such brief exposures at such close distances, because a half second more or less might make all the difference between success and failure. Consequently, with bromide papers, it is far more convenient in every way to increase the distance between the flame and printing frame and give a correspondingly longer time of exposure.

As the speeds of bromide papers by different makers vary considerably, the exposure with one kind cannot be taken as more than a suggestive guide for some other kind. Therefore I strongly urge the reader to select any one of the well-known makes and stick to that kind until a reasonable amount of experience has been gained—and even then not to change unless a very good reason presents itself. Each maker issues his bromide paper in a variety of grades, *e.g.*, glossy, matt or rough

(drawing paper) surface, thick and thin paper, white and tinted papers, cards, and so on.

On purchasing a packet of bromide paper, the first thing is to open the package in the dark-room, *i.e.*, lit by yellow light, and take out the paper of instructions and read it carefully. You will doubtless find some general guide as to exposure, *i.e.*, something like this, "With an average negative at three feet from a No. 5 gas burner the exposure will be twenty to thirty seconds." Now, of course, you will say "what is an average negative, and ought I to give twenty to thirty seconds." It is not possible to define an average negative, but I think you can get a fairly good idea in this way as to the kind of negative that gives the best bromide print. Lay the negative film side downwards (quite dry, of course) on a page of large type printed matter. When pressed down upon the paper you ought to be able just, and only just, to make out the edges of the letters through the densest part, while there should be seen faint detail in the most transparent parts.

Assuming we have such a negative, the question still remains whether we should give

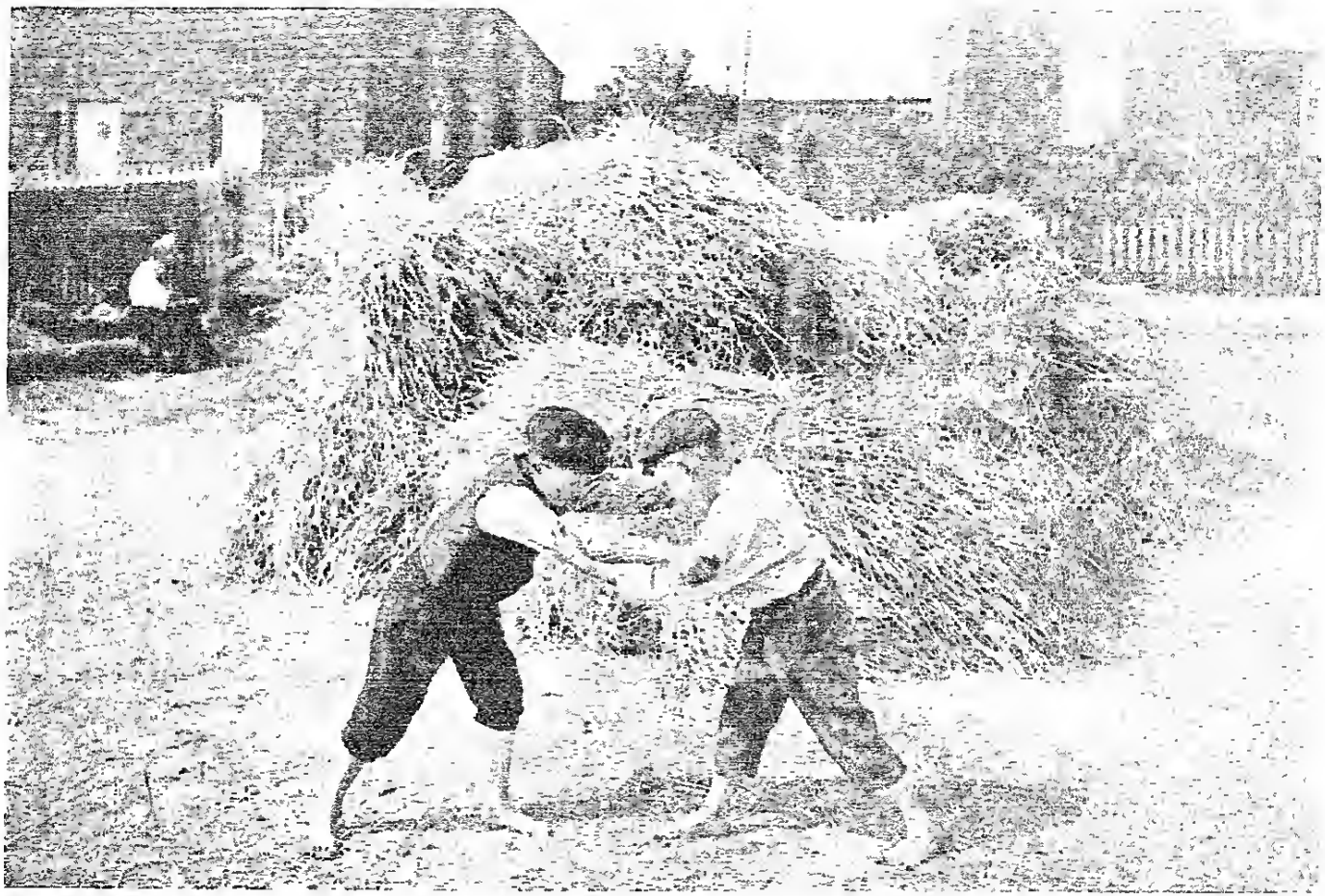


Fig. 24. Figure Study. (See page 203.)

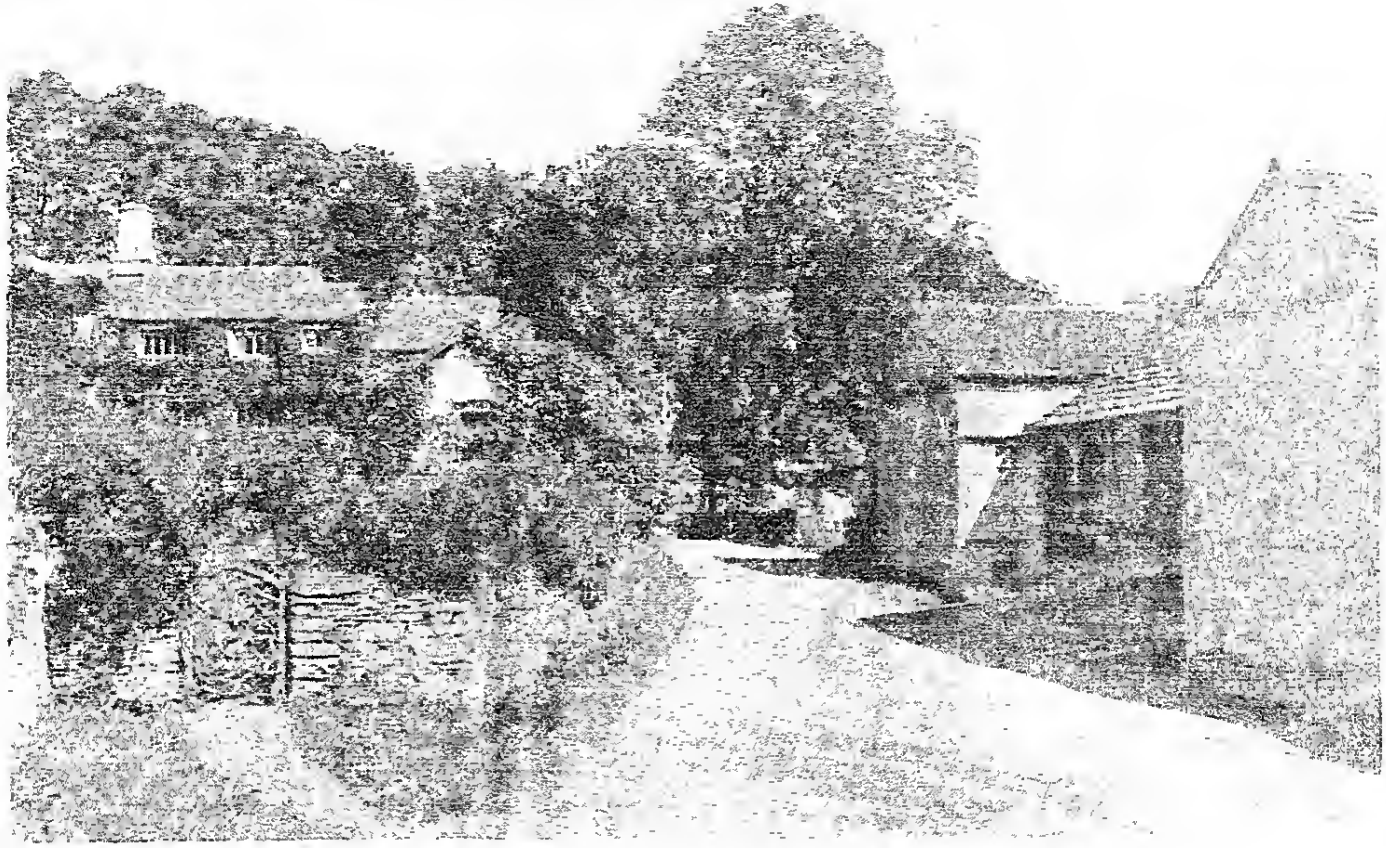


Fig. 25. Roadside and Cottage Scenery. (See page 201.)

twenty or thirty seconds. Why not twenty to one part and thirty seconds to another part of the print? In fact, why not give several different exposures to one piece of paper so that we may see what the result is, for this experiment is sure to be a valuable guide for future work. This is what is commonly called making a "test exposure" or "trial strip." And although it means wasting one piece of paper it means hitting the bull's eye at the second shot. Moreover, for our test strip we need only use a small piece of paper, so that our quarter-plate piece may be cut up into two or three trial strips.

In order to make this quite clear I am using for your benefit a trial piece the full size of the original (half-plate) negative. Suppose that we feel pretty sure that the exposure is somewhere between twenty and eighty seconds—a pretty good margin. I put a piece of bromide paper in the printing frame, sensitive or concave side towards the film of the negative. Then, at three feet from the gas, I expose the frame for twenty seconds. Then turn down the gas, and with a piece of cardboard (which I find used as packing in the package of paper)

I cover up one third of the glass side of the negative. Then turning up the gas, I expose the uncovered two-thirds for twenty more seconds. Again turn down the gas and slide the card along until I have covered up two-thirds of the negative. Again turn up the gas and give the uncovered remaining third forty seconds. Now let us pause a minute and consider what has happened. I think you will see at a glance, from the diagram, that the first strip had twenty seconds and no more. The middle strip had twenty plus twenty, *i.e.*, forty seconds, while the last strip had twenty plus twenty plus forty, *i.e.*, total eighty seconds' exposure.

20	20	20	First exposure.
20	20		Second exposure.
40			Third exposure.
80	40	20	Total exposures.

In this way we can give as many different exposures as we please to a trial strip. For example, we may be dealing with an untried brand of paper and be doubtful if the exposure is five or 150 seconds. In that case we should

begin with five, then another five, then ten, then twenty and so on, thus :—

First exposure	5	5	5	5	5	5
Second ,,		5	5	5	5	5
Third ,,			10	10	10	10
Fourth ,,				20	20	20
Fifth ,,					40	40
Sixth ,,						40
Totals	5	10	20	40	80	160

Now to return to my print which had twenty, forty and eighty seconds. The first is not enough, while eighty is too much. The middle strip is perhaps a shade too much, as it is getting a little flat, so that we conclude that thirty-five seconds will be about right. See figs. 14 and 16.

This we find to be the case, as is shown in fig. 15. But how am I to know when to stop development ? is a practical question. Your best plan is to make a trial or test development experiment. Having ascertained what you think is the best exposure, then take a fresh piece of paper and give it this exposure. Then cut it into three equal strips. Start all three strips in the same developer, but take out

one while it still looks decidedly under-developed and drop it straight into the hypo fixing bath. The next strip comes out of the developer when you think it looks just right. The dim yellow light will make it appear a little darker than it really is, but this will be compensated for by the print darkening a trifle on drying. Then let the third strip stop in the developer until you cannot get it any darker. This will require patience and perhaps take three or four times as long as the time taken to develop the middle strip.

In fig. 15 we have correct exposure with brief, A, moderate, B, and prolonged, C, development, or if you prefer it under, correct, and over developed.

Now, as regards development, no doubt the makers will give you a formula which you will be wise in following, if you have the materials at hand. But supposing that you are in a hurry to see what you can do with the one developer that I have mentioned on account of its simplicity, *viz.*, Rodinal. You can work bromide paper quite well with Rodinal and potassium bromide, which latter, no doubt, you have in solution.

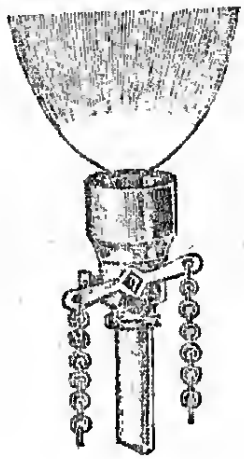
Into a 2-oz. measure drop just two drops of ten per cent bromide. Then add twenty minims of Rodinal and then 1 oz. of water, between 60° and 70°F., and pour this over the dry bromide print in a deep porcelain developing dish, carefully avoiding splashing or air-bells, and have patience, as it takes a little time for the developer to penetrate the paper and its coating.

The paper of instructions will tell you what proportion of hypo to dissolve in water for the fixing bath.

The fixing bath must not be too cold. In fact, if you do not want trouble with blisters, etc., see that the developer, dishes and all solutions are kept between 60° and 70°F.

Gas Jet. I mentioned turning down the gas jet during the test exposure just now. I do not mean turning it right out, but down to a tiny blue flame about one-third inch high. This will not do any harm unless the paper is brought close to it. There are on the market some useful gas burners arranged with a bye-pass shaded by a small hood. These are very convenient for the bromide printer. The annexed diagram shows a useful form, and

all we need do is to pull one or other of the little chains according as we require full light or practical darkness. This form is easily attached to any ordinary gas bracket.



Distance Gauge. I advise the beginner making all his bromide exposures at some one fixed distance from the gas flame, say three feet, and altering the duration of exposure according as the densities of the negative may require. It is a good plan to use a piece of stout string with a loop at each end. One loop is slipped over the gas jet, the other loop is slipped over the thumb of the hand holding the printing frame, which is thus held always at the same distance.

Sensitive Side of Bromide or Gaslight Paper. There are several ways of recognising which is the coated side of these papers. With glossy or shiny papers it is, of course, instantly seen or felt by touching an edge or corner. With non-shiny papers, as well as with shiny papers, we shall notice, if a sheet is laid down on the table, that it tends to curl slightly with the sensitive side inwards (concave).

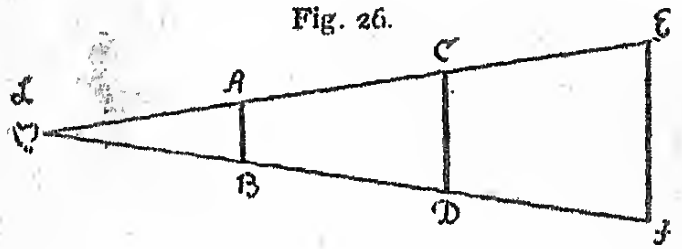
Even with non-shiny papers by the yellow light of the dark-room we can usually see that the coated side is less rough than the back of the paper. But failing these signs, we can make sure of the matter by moistening the tip of the first finger and thumb by touching them with the lips or tongue, then seizing the extreme corner of the sheet between the finger and thumb and pressing firmly for about ten seconds. Then on slowly separating finger and thumb we shall find that the coated side sticks either to the finger or thumb. Always avoid touching the sensitive side, and handle the paper by its back or edges only.

Time and Distance Law. Varying the exposure according to the distance between the light and printing frame is such an important

matter in many ways for the photographer that I invite the reader's very careful attention to this section.

Suppose we take a bit of a match AB (fig. 26) one inch high and hold it one foot from a small strong light L, and on the other side, one foot away from the match, we hold a sheet

Fig. 26.



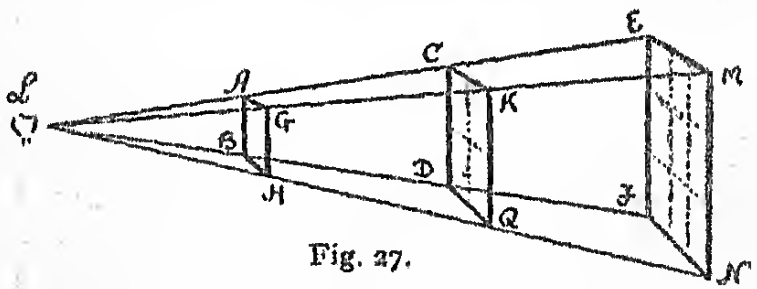


Fig. 27.

of white paper, we shall get a shadow of the match CD, two inches long. If now we move the paper one foot further away, *i.e.*, three feet from the light, the shadow EF will be three inches long. Whether we hold our match vertically or horizontally the result will be just the same.

If now we take a bit of card the same size as a postage stamp (ABHG fig. 27), and repeat our experiment, when the sheet of paper is two feet from the light we shall get the shadow of the CDQK just twice as high and twice as wide as ABHG. In other words, equal to four postage stamps edge to edge. If the sheet of paper is three feet from the light the shadow of ABHG will be EFNM, *i.e.*, three times as high and three times as wide as ABHG, or equal to nine postage stamps edge to edge.

If in place of a postage stamp we have a quarter-plate printing frame at ABHG, this would receive the same quantity of light that would cover four similar frames at CDQK, or nine similar frames at EFNM. Now as the same light which falls on the first frame at one foot is what would fall on four times the size of one frame at two feet and nine times that at three feet, the light at two feet must be only one-fourth as strong as it is at one foot and at three feet only one-ninth as strong as at one foot. Consequently if we expose our print for one second at one foot from L, to get the same effect at two feet we must

give four seconds, and at three feet the exposure would be nine seconds.

We now see that our rule is that the exposure at different distances varies with the square of the distance.

Now suppose you have learnt to expose at *three feet* and that you get another kind of paper which only mentions exposures at two feet. It is an easy matter to reckon what the equivalent exposure is. For example, Smith's paper of instructions says, forty seconds at three feet is right for an average negative, and you find this all right for one of your negatives. But Brown's paper of instructions says, twelve seconds at two feet is right for an average negative. The question is what exposure at three feet corresponds to twelve seconds at two feet. This problem is a simple rule-of-three, thus :—

As 2×2 feet is to 3×3 feet so is twelve seconds to required time, *i.e.*—

$$4 : 9 = 12 : 27$$

Thus, twenty-seven seconds at three feet with Brown's paper is equivalent to forty seconds at three feet with Smith's paper, or

Brown's paper is more rapid than Smith's in the proportion of twenty-seven to forty, or say thirty to forty, *i.e.*, three to four.

Again, suppose we want to get some idea of the relative rapidity or equivalent exposures of Walker's gaslight paper and Hawker's bromide paper. Walker's instructions are two minutes at six inches and Hawker says thirty seconds at two feet. Now two feet is four times six inches, so the equivalent times of exposure are in the proportion, not of one to four, but one to four times four, *i.e.*, one to sixteen. So that two minutes at six inches would be equal to sixteen times two minutes, *i.e.*, thirty-two minutes at two feet, for the gaslight paper. Comparing this with Hawker's paper, requiring half a minute at two feet, we find the proportion is thirty-two to one-half, or sixty-four to one. So that the bromide paper is more than sixty times as rapid as the gaslight paper.

This may seem a rather long and very dry talk about very little, but if you once get the drift of the thing clearly in mind you are not likely to forget it, and it will save you many mistakes, not only in gaslight and bromide

printing, but also in lantern slide making and enlarging.

Toning Bromide Prints. Although a good black and white bromide print suits many subjects, and takes a lot of beating, yet for certain purposes we want to change the black of the image to some other colour. I, therefore, propose selecting a few only of the scores of formulæ which have been published or proposed for the purpose of toning bromide prints.

It may be taken as a safe and first rule that for good tones we require a stainless print, well fixed and well washed after fixing. With any process employing potassium ferricyanide, if the washing after fixing has been insufficient, the ferricyanide with the hypo left in the print forms a reducer, and the image will be reduced or dissolved away.

Brown Tones. As the sulphide process is perhaps the most popular we may take that first. The well-washed print is first immersed in a bleaching bath. Of these I give two formulæ, either of which may be used with equally good results.

A. Water, 10 ozs.; Potassium ferricyanide, 1½ drms.; Potassium bromide, 1 drm.

B. Water, 10 ozs.; Potassium ferricyanide, 1½ drms.; Ammonium carbonate, 1 drm. (or liquid ammonia, 1 drm.).

The print after being immersed in A or B soon bleaches—that is to say, the black image is replaced by a yellowish-gray faintly-visible image in a few minutes.

The print is now washed for ten minutes and then it passes into the sulphiding bath C or D.

C. At any good chemist's we can buy a pale yellow liquid known to chemists as ammonium sulphide, but often called "stinko" by professional photographers, on account of its essence of rotten eggs odour. Of this liquid we only require 4 to 5 drops (not more) per oz. of water. And as "stinko" does not keep long in best condition it is better to buy a small quantity at a time, say 1 oz., unless you are going in for toning on a generous scale.

D. We have an alternative in sodium sulphide, a solid which easily dissolves in water. Of this we may also use 5 grains per oz. of water.

The bleached and washed print is immersed

in C or D, when the picture now returns to view, but is changed to a warm black or brown colour. It must again be well washed.

Red Tones are perhaps best obtained by copper. A good copper toning bath is made as follows: In 5 ozs. of water dissolve ½ oz. of potassium citrate, then add 30 grains of copper sulphate. When this is dissolved add 25 grains of potassium ferricyanide. The print is immersed, when it passes from black to purple, chocolate, and finally to red. It requires washing, of course, after toning.

Green-Blue Tones. Water, 5 ozs.; Potassium ferricyanide, 4 grains; Nitric acid, 4 drops; Ammonio-citrate of iron, 2 grains. The toned print requires washing in acid water, *i.e.*, one or two drops of nitric acid per pint of water.

The Carbon or Autotype Process. If we take a piece of white paper coated with gelatine, dip this paper in a solution of potassium bichromate and then dry it in the dark, we find it is a bright golden yellow colour. If now we print this under a strong contrast negative for a few minutes in bright daylight, we find that where the light has got through

the negative the paper has darkened to a dirty orange colour. Next, if we wash this print in *warm* water, a curious thing happens. The non-printed part of the gelatine dissolves away in the warm water, leaving white paper, but where the light has got through the negative, not only is the colour changed, but also the gelatine is rendered insoluble in the warm water, so that on the white paper is left the more or less feeble gray-orange image. If now, instead of using plain gelatine to coat the paper, we mix with it some exceedingly finely ground charcoal, lamp black, etc. (*i.e.*, carbon) and then repeat the experiment, we shall get our picture in black carbon, and white paper instead of in orange-gray. Instead of lamp black we can mix with the gelatine any other insoluble coloured powder, *e.g.*, burnt sienna, Prussian blue, etc., and so get prints in any colour. Here, then, is the basis of not only the "carbon" process, but of many other printing processes, including many of the methods of making the blocks used for illustrating books and magazines. It was called the "carbon" process, because carbon was the first pigment used, but when other coloured

materials became general it took the later name of "autotype."

In practice the procedure is not quite as above described, for reasons which need not now be gone into. It may suffice to explain the various steps.

1. The paper coated with coloured gelatine is called "tissue," and looks not unlike patent leather or American oilcloth on the coated side, but the back is ordinary looking paper.

Tissue may be obtained in about a score different tints, *e.g.*, black, sepia, sienna, sea-green, blue, red chalk, etc. We may buy it ready sensitized and cut up to ordinary negative size or in unsensitized form, in rolls, and cut it up and sensitize it as it is required. When sensitized it does not keep in order beyond about a week, unless special precautions are taken.

2. It is sensitized by immersion for three minutes in a bath prepared by dissolving 1 oz. of potassium bichromate in 40 ozs. of water; then drying the tissue in the dark by pinning it up by its edges to the edge of a shelf. The sensitizing bath keeps a long time and may be used over and over again. The tissue requires

some hours to dry, so it is best sensitized over-night and printed next day.

3. The tissue is already so dark in colour that little or no change can be seen during printing. We, therefore, measure the printing by means of a printing gauge. This is easily done in the following manner. The printing

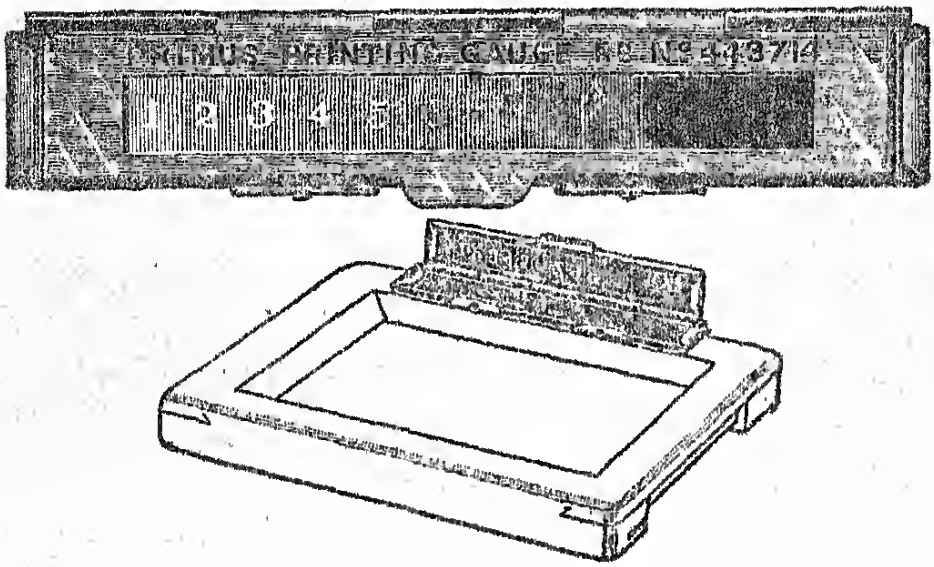


Fig. 28.

gauge is fastened to the edge of the printing frame containing the negative. Behind the negative is put a small piece (say the half of a quarter-plate size) of ordinary P.O.P., and a narrow strip of the same P.O.P. is put in the printing gauge. The printing frame is now exposed to strong diffused daylight until we

can just see clearly the details on the P.O.P. behind the densest parts (*i.e.*, high-lights) of the negative. When this is observed we open the printing gauge and notice the highest number visible on the narrow strip of P.O.P. Suppose that No. 9 is *just* visible. We now put the sensitized carbon tissue behind the negative, and a fresh bit of P.O.P. in the gauge, and examine the print in the gauge from time to time, carrying on printing until again we can *just* make out the figure 9. We now know that the carbon tissue is printed sufficiently, although very little, if any, change can be seen, on account of the quantity of pigment on the gelatine coating.

4. **A mistake.** Naturally you are now inclined to plunge the printed tissue in warm water, and expect a picture *instanter*. But this will not do at all, because the light passing through the negative has only affected the upper layers of the pigmented coating, while the under parts next the paper support are yet untouched and consequently soluble, so that a bath of warm water would dissolve these soft under layers and away would go our picture.

5. Transferring. We now take a piece of "transfer" paper, *i.e.*, paper coated with a trace of insoluble gelatine. Cut this half an inch larger than the printed "tissue," make a pencil mark at one corner of the *non-coated* side and plunge the paper in water at medium temperature (say 60°-70°F.) and let it there remain for five or ten minutes, with its coated side upwards. It is easy to know the back of the transfer paper from the front, by noticing that the coated side tends to curl inwards, and also the coated side feels a little more shiny or less rough than the back.

In the same dish as that containing the soaking transfer we now put the piece of printed tissue face down, and push it under the water. (A deep dish is desirable). Then turn the tissue over at once and sweep off any air-bells with a tuft of wet cotton wool. Now notice very carefully that as soon as the tissue is put into the water it begins to curl coated side inwards, but watch this for a few seconds, when you will see that it begins to flatten itself out again. As soon as this is noticed, then turn the tissue coated side downwards, bring it over the transfer paper (coated side

upwards), bring the two face to face and then slowly lift them together out of the water, let the water drip for a second or two. Then lay the two, now sticking face to face, on a sheet of glass and pass over the

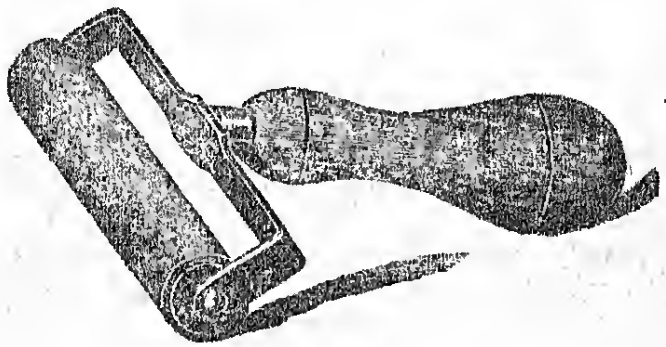


Fig. 29.

back of the tissue a roller squeegee two or three times, gently yet firmly. Begin the stroke at the centre of the print each time and work towards the edges. The object of this is to drive out not only superfluous water, but also any air bells which may have been enclosed between the two surfaces.

The tissue and support will now stick fairly well together. They are then laid between dry blotting papers and put under the pressure of a good-sized book or a brick wrapped up neatly in brown paper, and left for fifteen

minutes. As soon as the printed tissue is well wetted we can employ daylight for the rest of the operations.

6. Temperature. Meanwhile we put a kettle of water on the fire and heat the water until it is too hot to put a finger in without pain. We now mix some of our hot water with the cold water until the thermometer tells us the temperature is 110°F. For "developing" in this process, *i.e.*, dissolving by warm water, it is most convenient to use a deep zinc dish especially made for this work, but at first we can manage a few trials with a large washhand basin, a galvanized iron foot bath or an enamelled iron Yorkshire pudding baking dish. There is a risk of breaking an ordinary earthenware developing dish if very hot water be put into it, moreover, it holds so little water that the water soon cools.

Having got the water to 110°F., now plunge into it the transfer and tissue, which by this time are firmly stuck together. Brush off any clinging air-bells by a touch of the finger tip. Then let them rest in the water and watch until you can see a little colour oozing out between the edges of the tissue and the support.

Now gently raise one corner of the backing paper of the tissue and draw this corner back over the print, and so peel off this supporting paper. This paper has done its purpose and is thrown away. Meanwhile, you see nothing like a picture yet on the support, but only a dirty-looking mass. Now take a small mug or cup, or use the hollowed hand, and gently lave warm water on to this mass of pigment. In a minute or so signs of your picture will begin to show, but continue the gentle laving until the picture is fully out, *i.e.*, until all the soluble (non-printed) part is washed away, leaving the insoluble picture on the support. This may take five or ten minutes' slow and steady laving to get out all parts of the picture, which now should look just a suspicion too light, as it will go a trifle darker on drying. When sufficiently developed, the print is removed from the warm water bath to the alum bath, *i.e.*, a cold saturated solution of common alum, wherein it remains five minutes, and then is washed in half-a-dozen changes of water, and then pinned up to dry.

7. **Reversal and Safe Edge.** You will probably notice two things about your print.

First, its edges are unsatisfactory and perhaps frilling and blistering and inclined to come away from the support. This is easily prevented in your next print by "safe edging" the negative, as it is called. This is done by pasting to the *glass* side of the negative (*i.e.*, all the way round the four edges) a strip of opaque paper, *i.e.*, black, brown, orange or red paper, but black is best of all. This safe edge need only be about $\frac{1}{4}$ inch wide, so that we may very conveniently use lantern slide binder strips, which can be bought in black very cheaply, and we have the convenience of the paper being already gummed.

The next thing you will notice is that the picture is reversed, as regards right and left. That is to say, if your original subject was a person with an umbrella in his right hand your carbon print will show him as holding it in his left hand. In pictorial landscapes this will not often matter, but in architecture, portraits, etc., we may get some puzzles by the reversing of the picture.

8. **Double Transfer.** The process just described is called "single transfer" and gives the kind of reversal of rights and lefts

like that we get when seeing an image in a looking glass. This is got over by again reversing the print. Briefly thus, the carbon print is transferred to what is called "temporary support," and developed as just described. Then this is brought face to face with a piece of final "support," squeegeed and dried. The two are then separated, when the print leaves the temporary support (where it was reversed) and sticks to the final support, when it is once more reversed, and so right way round again.

Ozotype. This process will quickly be seen to be closely related to the carbon process just described. It must suffice for us to give in outline the steps and refer the reader to the gratis pamphlet sent to purchasers of the various materials from the Ozotype Company.

1. **Paper Coating.** Any good quality paper, such as drawing paper, is brushed over with a special ozotype sensitizing solution. This is quite cheap, as only a dram or so is required for a large sheet of paper. It is now dried in the dark and is then bright yellow. As soon as it is dry, which need not occupy many minutes, it is printed under a negative and gives a grey-orange image. The paper is

now well washed until all yellowness is gone and only the faint yellow-gray left. We can now dry the print and proceed to the next stage at any subsequent time, or proceed to steep it at once.

2. Acetic Bath. We now prepare a bath of: Water, 40 ozs.; Glacial acetic acid, 1 drm.; Hydrokinone, 20 grs.; Ferrous sulphate, 10 grs. This is put into a deep dish and warmed, if need be, until it is between 60° and 70°F. We now take a piece of "pigment plaster," or failing that, we may use ordinary carbon tissue, but the former is preferable, being specially made for this process. It is then immersed in the above so-called "acetic bath" for two minutes, or rather less. A print, made as already described in (1), is now plunged into the acetic bath for a few seconds, *i.e.*, just long enough to properly wet the paper, and then brought face to face with the pigment plaster, withdrawn and squeegeed into good and even contact. They are placed between blotting paper for a few moments and then hung up to dry together. When dry, we proceed to "develop" the print just exactly as already described under carbon printing (6).

3. Points. Now it should be noted carefully that in this process we use daylight to print an image in bichromated gelatine (with other things) and then the carbon print is developed on the top of this image. Thus it differs from ordinary carbon, where we print our image in bichromated pigmented gelatine.

There are numerous other points of similarity and differences into which we need not now enter.

After developing the print is rinsed, alumed, washed and dried as in carbon printing.

4. In ozotype there are three points worth noting, as they mark the contrast between this method and ordinary carbon. First, we judge our printing by examining the ozobrome paper in the printing frame, and so do not require an actinometer, except for cloud combination printing, and other special delicate work. Next, we do not need a "safe edge," and third, as there is no transfer there is no right to left reversal of the picture. Another point may be mentioned. In carbon, we must either develop the print soon after exposure or take special precautions as to

keeping it light and moisture-proof in a calcium tube. In ozotype the washed print may be kept any length of time before pigmenting.

Ozobrome Process. The reader doubtless will at once guess that this process is a relation of ozotype. This is so, and both are due to the same originator. They both present various special features which have their corresponding advantages.

It will be remembered that in ozotype we make a faintly visible print by daylight and then pigment this in any light that may be convenient.

In ozobrome we are independent of daylight altogether, and begin with an ordinary bromide print as our basis in the following manner.

Procedure. Into a porcelain dish P we put 4 ozs. of ozobrome pigmenting solution (a patented preparation) and 16 ozs. of water. In a second dish A we put 25 ozs. of water and 1 dram of hydrochloric acid. We also need two more dishes, X and Z, of any kind that will hold water to a depth of an inch or more. Take an untoned bromide print, preferably one well developed with amidol,

and soak it in Z, face upwards, carefully avoiding air-bells clinging to either side.

Now cut a piece of pigment plaster (or carbon tissue) just a trifle (*e.g.* ⅛ inch) larger than the bromide print and immerse the plaster in the acid bath A for just half a minute. Then lift it out by the corners and let it drip and drain for a few seconds. Then plunge it into the pigmenting bath P for just 1½ minutes. Now remove it by two corners and lay it *face down* on the surface of the water in bath X, and draw it across the water. Repeat this, then lay it face down in bath Z, which contains the bromide print, face upwards. Now *quickly*, but without fluster, bring their two surfaces together so that the plaster extends ⅛ inch all the way round beyond the bromide print, withdraw together and squeegee into good contact, being careful not to shift the two about when once they are in contact, because as soon as they come into contact the printing effect commences and so any shifting means a blurred or double image. The two now remain in contact for 15 to 20 minutes.

Two Courses. Now two different courses

Fig. 30. Exterior Architecture. (See page 205.)

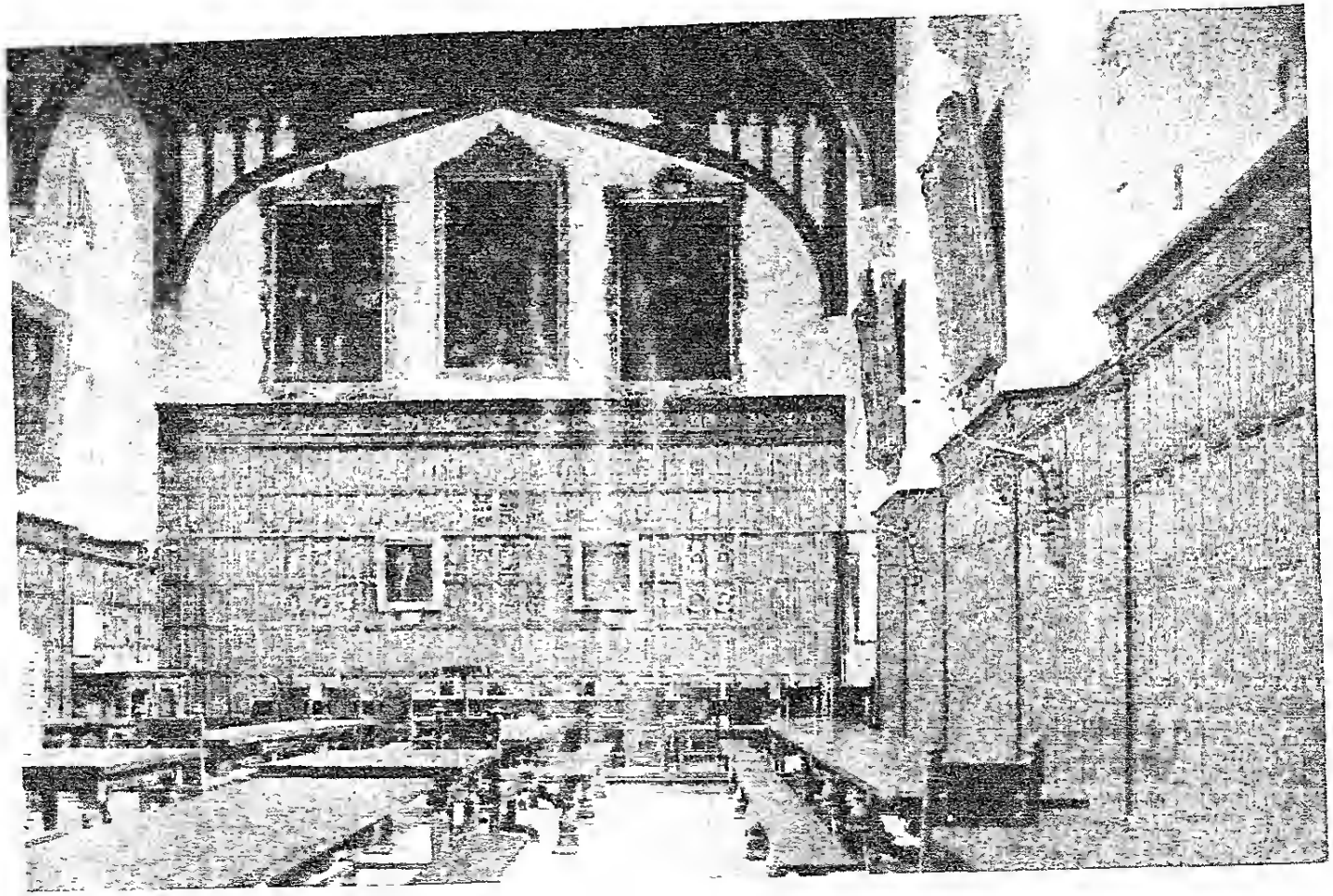


Fig. 31. Interior Architecture. (See page 207.)

are open to us, so to illustrate them both we will cut our plaster and bromide print into two equal parts, No. 1 and No. 2. We next immerse No. 1 in water at 100-105°F. for a few minutes, *i.e.*, until the pigmented gelatine softens and begins to ooze or tells us, by feeling the corners, that we can strip off the backing paper of the pigment plaster or tissue and then proceed, just as we did in ozotype or ordinary carbon, to "develop" the picture by laving with warm water. In fact, the process compares with ozotype, except that here we develop a carbon print on the top of a bromide print, which, during the process, has been bleached. We may wish to remove this bleached bromide print image, which can be done by immersing the finished (*i.e.*, hot-water developed) print in Hypo, 2 ozs.; Water, 20 ozs.; Potassium ferricyanide, 1 dram.; then well washing and drying.

Observe that by this process we do away with a bromide print and replace it by a carbon print.

Second Method. Going back to the other half of the bromide print and pigment plaster No. 2, take your two dishes X and Z and fill

up with fresh cold water, at or about 60°F. In Z lay a piece of transfer paper, face upwards, and let it soak for two minutes. Then immerse the print and plaster No. 2 in dish X and after a few seconds separate them at one corner and then gently, but firmly, draw them apart under water. The bromide print will be found to have become bleached. Leave that in dish X and transfer the image impressed plaster or carbon tissue, face downwards, to dish Z, bring together face to face the plaster and soaked transfer, remove together, squeegee firmly and lay between blotting papers for fifteen minutes, under pressure. Then proceed to develop in hot water just as in the usual way.

Returning now to the bleached print, it is washed for fifteen minutes and then redeveloped by any ordinary quinol, amidol or metol developer, washed again (but not passed into any fixing bath) and dried.

We may then start again, *de novo*, and thus theoretically make any number of ozobrome prints from the same bromide print, but probably it will get scratched, torn or otherwise damaged ere long.

Now the special points about this process are first, that we can make our bromide prints and from these our carbon ozobromes without daylight at all.

Another strong point is that we can use a direct contact bromide print or a bromide enlargement and so get carbon enlargements. Again, as in ozotype, we do not get right and left reversal of the image. We also do away with safe edging, separate sensitizing and drying of the tissue, etc.

As in carbon we have a choice of various colours, also rough and smooth, white and tinted transfer papers, etc.

Oil Printing Process. This again is essentially a bichromated gelatine process. For a first experiment the reader may proceed as follows and obtain a very fair result, but this will not, of course, be so good as may be obtained when using materials especially made for the purpose.

1. Immerse a piece of single transfer paper, as used in the carbon process, in a sensitizing bath made by dissolving 1 oz. of potassium bichromate in 20 to 25 ozs. of water. Let the paper remain until quite

limp, which will require from one to two minutes. Then remove, drip and drain and pin up to dry in the dark.

2. **Printing.** Select a moderate contrast negative and print the paper (in diffused daylight) behind this negative until the highlights are just, but only just, visible. (Over-printing is fatal). Now wash the print in cold water, *i.e.*, 60°-70°F., until the water no longer shows any yellowness, *i.e.*, about fifteen minutes will suffice.

3. **Blotting Pad.** Now take three or four sheets of blotting paper each half-an-inch larger all the way round than the prints. Dip them in water and lay in a pile on a sheet of glass and let the superfluous water run away at one corner of the glass.

4. **Drying the Print.** Lay the wet print, face up, on the pile of blotting paper. Fold up a clean dry old handkerchief into a pad and dab this on the surface of the print until you cannot see any surface water standing on the print. If, now, you look at the print at an oblique angle, by reflected light, you will just be able to see here and there parts of your picture in very low relief, due to the

gelatine being swelled in some parts more than in others, according to the varying amount of light action, *i.e.*, the more light the less the swelling.

5. **Inking the Print.** We now take a small dab of greasy, thick lithographic ink, which looks like stiff tar, spread it out into a thin layer on the back of a dinner plate with the aid of an old table knife. Then take a soft hog-hair brush and lightly dab the ends of the brush on this layer of ink once or twice, then lightly dab the brush on the print. After a few dabs we shall find that the ink here and there leaves the tips of the brush and clings to the print.

6. **The Principles.** The essence of the matter is this. Where light has acted through the negative on to the paper (*i.e.*, in the shadows of the picture) the greasy ink adheres to the print, and we then get the dark parts of the picture. But where the dense parts of the negative protect the paper from the action of light, there the gelatine swells up and repels the greasy ink, and thus we get the high-lights of the picture.

limp, which will require from one to two minutes. Then remove, drip and drain and pin up to dry in the dark.

2. **Printing.** Select a moderate contrast negative and print the paper (in diffused daylight) behind this negative until the high-lights are just, but only just, visible. (Over-printing is fatal). Now wash the print in cold water, *i.e.*, 60°-70°F., until the water no longer shows any yellowness, *i.e.*, about fifteen minutes will suffice.

3. **Blotting Pad.** Now take three or four sheets of blotting paper each half-an-inch larger all the way round than the prints. Dip them in water and lay in a pile on a sheet of glass and let the superfluous water run away at one corner of the glass.

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7. **Special Materials.** The reader will now understand that he is likely to get the best results by employing paper especially designed for use in this process (which is in essence a very old one recently revived). Special brushes, special inks put up in tubes like oil paints, and one or two other sundries also help considerably in facilitating matters.

Now the reader must notice that in this process there are one or two special features. While we start with a photographic basis, yet we are really painting the picture on this photographic foundation. We can put on much or little ink, we can use different coloured inks on the same print, etc.

Hence while it offers a wide field for those who possess artistic taste it also offers endless pitfalls for those who have had no previous art training and trust to luck to give them something good. It is more a process for the pictorial expert, who has both knowledge, skill and judgment, than for the everyday photographer.

Bromoil. This is related to oil printing, as already described, but, as in Ozobrome,

so in Bromoil, we use a bromide print as the basis for our picture.

In brief, the process is as follows. A well-developed and preferably fairly vigorous bromide print is bleached in one or other of several solutions. It is then bathed for three minutes in a 5 per cent aqueous solution of sulphuric acid, washed, then passed into the following bath: Water, 20 ozs.; Hypo, 2 ozs.; Soda sulphite, ½ oz.; where it remains five minutes. It is then washed for five minutes and then pigmented by brush dabbing, just as described under oil printing.

It should be noted that this process can be carried out just as Ozobrome can, without any daylight at all, but on the other hand, we must not forget that each Bromoil print born means the death of a bromide print.

The fact that we can make enlargements in this process from small negatives without resort to daylight or large negatives, is a point in its favour. But, as mentioned in oil printing, while it offers great facilities to those possessing artistic judgment, it offers many pitfalls for those not so favoured.

Bleaching Baths for Bromoil.

1. A special Bromoil solution is sold, which merely requires diluting with three volumes of water.

2.

Ozobrome solution	4	parts
Alum, 10%.....	4	,,
Citric acid, 10%	4	,,
Water to make	20	pints

Gum Bichromate Printing. This is often referred to as though it were quite a modern invention, but it owes its origination to Pouncy (Dorchester), who introduced it in 1858.

In brief the process consists in mixing a solution of gum arabic, potassium bichromate and some such finely ground pigment as ivory black in suitable proportions, and then brushing this mixture over a sheet of paper and drying it in the dark. It is then exposed under a negative in daylight, when a faint image can presently be seen. The print is then developed by floating it, face downwards, in tepid water. Thus it will at once be seen to resemble the ordinary carbon process without the transfer step. It offers various possibilities of local treatment of the print.

1. The paper selected should be of good quality and well sized, but not too smooth. Parchment wove note paper will serve excellently for a start. Thin drawing papers are also good.

2. **Coating Materials.** Crush 1 oz. of clean gum arabic to a rough powder, add 3 ozs. of tepid water, and stir with a glass rod at frequent intervals. Keep the bottle in a slightly warm place, *e.g.*, on the mantelpiece of a room where there is a fire (but guard against dust entering the bottle), as warmth assists solution, which is in this case a rather slow business.

In a 4-oz. clean bottle put ½ oz. of powdered potassium bichromate and fill up the bottle with warm water so as to form a "saturated solution." Procure an ounce of dry powder ivory black.

3. **Coating Mixture.** Measure out ½ oz. of the gum solution, filtering it through a double thickness of muslin, and put it in a saucer. To this add an equal quantity of the bichromate solution, weigh out 30 grains of ivory black and mix this thoroughly with the gum and bichromate solutions.

4. **Coating the Paper.** On a drawing board tilted like a writing desk lay a couple of sheets of newspaper. On this place your sheet of paper to be coated. Fix it by two pins at the top corners.

Now take a 2-inch wide soft, flat, hog-hair brush, dip this in the mixture (3) and sweep it from left to right along the top of paper and follow this by another stroke which just overlaps the edges of the first stroke, and so on until the paper is all covered. Then with vertical strokes even out the coating. The coating must be done quickly, lightly and evenly. Some little unevenness is likely to result at first, but dexterity soon comes with practice.

Every beginner puts on far too much pigment. It is difficult to describe how much to put on, but it will be a good guide if, on a piece of paper, you sign your initials in bold letters with a dark pencil, then the coating must not be so thick that you cannot see your pencil writing through the coating. The paper is now dried in the dark in a place as free from dust as possible. When dry, the sooner it is printed the better.

5. **The Negative.** We get the best effects in this process with a rather soft contrast negative of a simple and bold subject. Print in strong diffused daylight until the shadows are well defined, or print by means of a printing gauge, as described in the section devoted to carbon printing. First dip the print for a few minutes in water about 70°F. and then let the print float face down and develop itself. It requires turning over once or twice at intervals so as to loosen any pigment not fixed by printing.

6. **Pictorial Quality.** The pictorial essence of this process lies in the fact that we can very considerably effect the final result by local development.

The well-soaked print is laid, face up, in the water and then with a very soft brush the pigment is here and there "assisted" to come away from the paper. Another method is to fix the print on a sloping board and play on it with a fine spray of water from a hand-pressure scent spray—or throat spray bottle. Thus, one part can be hastened or lightened while other parts are left behind in the race.

7. **Control.** Like all processes offering methods of control in the production of the print their facilities may easily become dangers in the hands of those devoid of sufficient artistic judgment to guide their actions.

After development the print is rinsed in *cold* water and then hung up to dry in a cool and airy place. If the weather is warm there is a danger of the print "running" into a smudge before it is dry. It is, therefore, important to guard against using anything like warm water for developing. The cold-water spray, with intervals of floating face downwards, is the best method of treating the print. Rough surface as well as smooth papers of many kinds may be used in this process.

Blue Printing or Ferro-Prussiate Process. This is perhaps the simplest of all methods of making a print, and perhaps also it was the first real and practical printing process. It is due to Herschel and was in use as far back as 1840.

A sheet of white paper is coated with a mixture of two chemical substances in water, dried, printed by daylight, washed in water,

dried, and the thing is done. It is not easy to imagine anything simpler than that?

I certainly advise every beginner in photography to make a few "blue prints," as they are commonly called, because the process so well exemplifies the principles of light producing a chemical change that we can use for copying, not only a photographic negative, but other things, such as maps, plans, lace, leaves, stencils, etc.

1. In one ounce of water dissolve 80 grains of ammonio-citrate of iron, a substance commonly sold in the form of dark red-brown scales. In another ounce of water dissolve one dram of potassium ferricyanide, *i.e.*, "red prussiate." This is or should be bought as dark-red crystals. If the crystals or lumps have a yellow powder-like surface, dip them in water for a second or two and then roll them about on a piece of blotting paper to dry them and then weigh out the required quantity. Mix the two above-named solutions together and then filter.

2. **Coating the Paper.** For first experiments we may use a few sheets of good stout writing paper or drawing paper. For a

coating brush use a bit of quite clean Turkey sponge (or failing that, a tuft of cotton wool) tied to the end of a small strip of firewood. Pin the two top corners to a drawing board. Tilt up the board with a book or plate box to give a slope like a writing desk. Dip your brush in the solution and shake off the drops, then give a steady sweep along the top edge from left to right, then another sweep from right to left a little below and just overlapping the first stroke. Dip the brush again and sweep first one way and then the opposite, always letting one stroke just overlap the lower edge of the last stroke. Then pin the sheet up to drip for a minute or so, and then dry in front of a fire. Coating may be done in the daytime if the blinds are drawn down, but the less light the better.

The coating mixture will keep fairly well for some time *in the dark*, but, new or old, it should in any case be filtered just before use. Best results are obtained with fresh mixtures. There is a green variety of ammonio-citrate of iron, which may be used in place of the brown scale kind. This gives a rather quicker printing paper.

A still more rapid printing paper is obtained by adding a certain quantity of uranium nitrate to the mixture.

3. **Printing.** The coated paper will keep a few days, but is better printed as soon as it is dry. A plucky negative gives the best results. Printing is best in good, bright, direct sky light, but after a little experience a vigorous negative may be printed in sunshine. Printing should be carried on until the parts of the paper under the thinnest portions of the negative are olive green. (With some papers printing shows a bronzed surface). The print is now dipped in water for a few seconds and then floated on the surface of the water, face downwards. The water dissolves out the non-printed part leaving us a picture in "Prussian blue."

If your tap water contains "lime," the resulting prints are likely to be poor and feeble, because the "lime," *i.e.*, calcium carbonate, acts upon the image. In that case you can counteract the lime by adding just enough citric or sulphuric acid to make the water turn blue litmus paper red—a drop or two of sulphuric acid per pint of water will usually

suffice, but notice that any excess of sulphuric acid gives the print a greenish tinge. There are various ways of "toning" or changing the colours of these prints, and also methods of intensifying and reducing them, but I do not recommend any of these procedures at this stage of the worker's process.

4. **Suitable Subjects.** The subjects best suited for printing by this process are cloud pictures, seascapes, moonlight effects among ruins, decorative designs.

Titles. The title of a blue print in white may be added by writing on a blue part of the print with a quill pen and ink made by a saturated solution of oxalate of potassium thickened with a little gum water.

Applications. It may be worth while mentioning that this process is used by architects, engineers and others for copying maps, plans, drawings. If any design is drawn in good opaque ink on tracing paper, this may be used in place of a negative. A sheet of clean glass is put in the printing frame, then comes the drawing and then the sensitized paper. The parts protected from light by the opaque ink come out white, while the other parts

come out blue. Post-cards can be sensitized in this manner, and a spray of fern fronds laid on glass used as a negative.

Platinotype Process. This process stands apart from most of the other printing processes of to-day, and has many adherents among pictorial workers on account, not only of the beauty of the results, but also of their high order of permanency. Although the paper costs more than some other printing processes, the subsequent cost of working is little, and if due care be taken the percentage of failures should be small.

1. **Danger of Damp.** First and foremost it must be recognised that the prepared paper is easily affected and consequently spoiled by damp. Therefore, it is sent out in sealed tin tubes. On opening one of these tubes—which is a quite easy matter—the contents are forthwith transferred to a special storage case or tube, fitted with an air-tight lid. At the bottom of this tube is a chamber containing a small quantity of calcium chloride. This substance has the property of attracting to itself the moisture which is in the air inside the tube, and so preserving the paper. But

each time the tube is opened to take out a piece of paper some damp air enters, so that presently the calcium chloride lumps get so filled with moisture that they can hold no more. At this point it is necessary to take them out, put them on a shovel, and roast them over the fire until they are once more dry, when they may be returned to the tube and do their moisture-absorbing duty again; thus, if properly attended to at frequent intervals they last a very long time, and thus the papers in the tube may be preserved for a long time in working order. Nevertheless, it is better not to count on them too much and to buy the paper from hand to mouth, as it were.

2. **Printing.** A piece of paper taken from the storage tube is put in contact with a negative (the yellow side is the sensitive side). Then behind the white side of the paper is laid either a sheet of rubber tissue or an old celluloid film negative, so as to keep the paper dry while it is in the printing frame. Printing is done in bright diffused daylight or in sunshine in the winter. The printing frame has to be opened now and again to examine the

progress of affairs, but this must be done as quickly as convenient, in subdued light, (inside a room), as the paper is easily degraded by exposure to light. Light passing through the negative darkens the paper to a greyish tinge, but the effect is not very pronounced. Printing is carried on until the details of the highest lights are barely (doubtfully) visible. If a printing gauge is used, the printing frame need not be opened until the print is finished.

3. **Developing the Print.** The print is now taken from the printing frame, held by opposite corners and curled slightly coated side downwards and convex and laid down on the surface of the developer. In a few seconds the image makes its appearance in a fine, rich, black image, and very much stronger than is suggested by the faintly visible image before development.

4. **Clearing Bath.** The print is now fixed or " cleared " by immersion in Water, 60 ozs. ; Hydrochloric acid, 1 oz. ; for five minutes, then passed into a second bath of the same composition, and again into a third, allowing fully five minutes in each clearing bath, then washed

for ten minutes in gently flowing water and dried. Thus the process is one of the simplest.

4. **Varieties.** Several varieties of the paper are available, *i.e.*, on rough, smooth, thick and thin papers. The cold-bath papers may be developed with the solution at 65-70°F. The hot-bath papers require the developer to be heated to 120-150°F. Some, again, give a rich and fine black and white picture, while the sepia papers give prints of a warm sepia colour.

The hot-bath papers may be developed by preparing a cold saturated solution of potassium oxalate and then heating this solution to 120-150°F.

For a cold-bath developer take 30 ozs. water and dissolve in it 5 ozs. potassium oxalate and 1 oz. potassium phosphate.

5. **Local Development.** Platinotype prints may be locally developed by mixing the developer with glycerine and applying it with a soft paint brush. Vignetted effects can thus be obtained.

6. **Colour.** Warmish tones or colours can be obtained with "black" paper, by

adding a certain quantity of mercuric chloride to the potassium oxalate developer.

The temperature of the developer also affects the warmth of the colour to some extent, *i.e.*, the hotter the developer the "warmer" the colour, but the range thus available is not very great.

7. **Transparencies.** Platinotype prints on thin paper can be rendered more or less translucent by wax, Canada balsam, etc., and so form pictures suitable for window transparencies, fire screens, etc.

Trimming Tools. It is important that the edges of your print should cut quite truly straight with a clean cut. For this you require a sheet of thick card or strawboard to cut on, a print-trimming knife, of which various forms are to be had at a quite moderate price, and a straight edge, preferable of metal, so as to get true straight lines. For cutting prints to circular form a special apparatus may be bought.

Pictorial Trimming. It is the exception rather than the rule that the amount of subject included on the plate is quite the best

picture. Often we can add to the interest by *subtracting*, *i.e.*, trimming away some of the print. Just how much to cut away is a matter of taste and judgment, requiring thought and cultivation, so that if in doubt only the smaller part should be cut away first, and then the remainder may be removed if the first trimming is not satisfactory.

Composing Gauge. In order to facilitate the worker there has recently been put on the market the Maitland Composing Gauge. This is a sheet of transparent material ruled with many lines about ¼ inch apart. It is laid on the print and then pin pricks are made at the corners of the selected composition. These pin point marks now show on the print and enable any one to get true right angles as well as straight edges when the print is trimmed. The transparent gauge may be used again and again. Moreover, as the pin pricks show through to the back of the print the print can be turned over and cut back upwards, which enables us to get a cleaner cut in some cases. This is an especial advantage with thick papers.

Mounting a Print is really a very simple

operation if gone about in the right way, yet is often sadly bungled, and the result very untidy. It is important to use a proper *mountant* or adhesive material. Ordinary office paste, gum, and such like things will cause the print to fade or discolour. Various mountants specially prepared for photographic work are on the market at quite moderate prices. If preferred, starch paste made as below described may be used, but it will not keep and must be used within 24 hours of mixing.

Starch Paste Mountant. Take a teaspoonful of dry white starch, put it in a breakfast cup, and crush the starch to powder with a clean teaspoon. Now add 3 teaspoonfuls of cold water and rub into a smooth white creamy mixture. Then get some one to pour a steady stream from a kettle of boiling water while you stir briskly. As soon as the starch mixture turns from a chalk and water like mixture to a clear semi-solid jelly stop the water supply and stir well for a half minute. Then add about a tablespoonful more hot water and stir again. Use the mixture as soon as it is cold. If time presses it may be turned out

into a soup plate and stirred, and will then soon go cold.

Mounting Prints. Soak the prints in cold water for ten minutes, then withdraw them one by one and lay in a neat pile face down on a clean piece of thick glass or the back of a dinner plate. Gently press out the water with a dry towel. Dry the back of the top print with clean blotting paper. Apply a thin layer of starch paste or other mountant to the back of the print. With a blunt knife separate one corner of the top print from the rest of the pile. Handle the print without touching the edges of the starchy back more than can be helped. Lay it in position on the mount and then gently press it evenly down in its place by lightly dabbing with a clean dry pocket handkerchief or duster, taking care to work out to the side any air bubbles between the print and mount. The wet print must not be rubbed, but the dabber used with a rocking kind of rolling pin action working from the centre outwards.

Stereoscopic Photography. If you close this book and then hold it with its back edge towards you and exactly in front of the nose,

Fig. 32. Flower Study. (See page 208.)

i.e., equally placed between the two eyes, you will find that at about 10 inches from the eyes you can see three parts, viz., the back edge, the front cover, and the back cover, and that it looks like an ordinary solid book.

Now close the right eye and you will only see the back edge and front cover. Now using the left eye only you see the back edge and back cover. Here then is the essence of stereoscopy, viz., that the two eyes see slightly different views of things, and when both eyes are open these different but duplicate pictures are combined by the brain and give us the idea of solidity.

A stereoscopic camera is really a two-eyed camera, *i.e.*, having two lenses side by side, and therefore seeing slightly different views. An opaque division runs down the camera midway between the lens, so that really we have two cameras side by side, using one plate for two pictures made at the same time. But a very old and yet still used method is to employ only one camera and shift it sideways by means of an ingenious arrangement fitted to the tripod top, thus taking the two pictures one after the other

from the two different standpoints. The obvious disadvantage is that it is not suitable for moving objects or for hand camera work. The two-picture negative is developed in the usual way, and then printed, but we now find that the picture seen by the right eye is on the left side of the print, so that the print

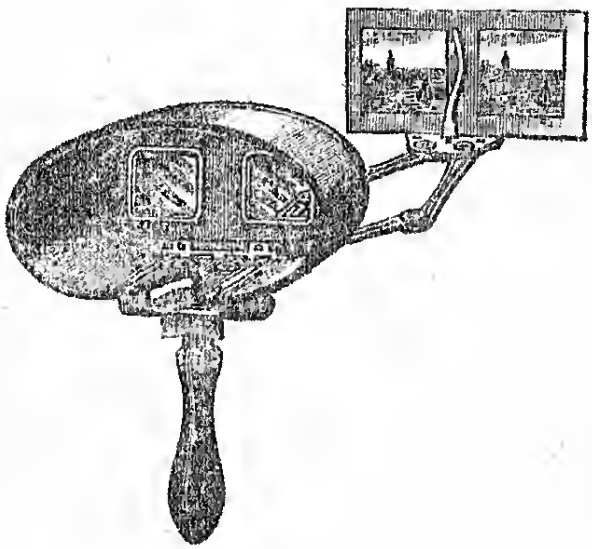

Fig. 33.

has to be cut in half and then the two portions properly placed again—*i.e.*, mounted side by side. When they are viewed by means of a stereoscope (of which fig. 33 shows a very convenient and compact folding form) the suggestion of solidity is often quite startling in its reality.

For stereoscopic work it is advisable to select subjects containing a fairly strongly marked foreground.

For further practical information on this fascinating branch of work the reader is referred to a pamphlet issued gratis by Messrs. Butcher & Sons, entitled STEREOSCOPIC PICTURES, and how to make them.

Photography with Films. The question of the weight and fragile nature of glass plates versus the lightness and convenience of non-breakable films is a very important one for the tourist. Although I advocate the photographer commencing his experience with glass plates it by no means follows that after a few preliminary experiments he should not pass on to films. Glass plates are easier to manipulate in many ways, and therefore they are the best for the beginner. But any one who has used one or two dozen plates need not have any hesitation in tackling photography with films.

Films are of two kinds, or rather they are used in two slightly different ways. In the first place they may be made in a long roll like a roll of wide ribbon, or this roll may be

cut up into pieces, each the same size as a glass plate. The "cut films" are held flat in film carriers and then used just like glass plates so far as exposure goes, but in developing there are slight differences as regards the handling in the developing dish to prevent them curling up or scratching each other with their sharp corners. The roll film, consisting of six, twelve, or more exposed pieces side by side, may be developed all together in one long strip or cut up and dealt with separately.

As a film is so very much thinner than a glass plate it has the advantage that it can be printed either way round in the printing frame, and so in the carbon printing process it at once gets over the reversal of the image for us.

Films can be enlarged just as can glass plates, and also lantern slides can be made from them.

Book about Film Photography. Now as Messrs. Butcher & Sons issue a companion volume to this one, which deals very fully with Photography with Roll Films, I cannot do better than commend this book to all who are interested in this matter.

Lantern Slide Making. The beginner often thinks that this is a difficult matter, but let him imagine that a print made on paper had been made on clear glass and then he will see that it is a quite simple business. There are two chief methods of making slides, first *by contact*, second through the camera. Let us begin with the contact method as being the easier and requiring no more apparatus than the making of a contact print.

Lantern plates are in this country all made one standard size, *viz.*, $3\frac{1}{4} \times 3\frac{1}{4}$ inches, and this agree exactly with the size of the shorter side of a quarter plate, so that a lantern plate easily goes into a quarter plate printing frame. They are put up and sold in boxes containing one dozen plates at the usual price of 1s. per box. Having opened the box of plates (in the dark room) we glance through the paper of instructions, and can then make out first experiment.

Select a negative showing moderate contrast of light and shade—such an one as gives us a *bright* but not black and white, "soot and whitewash" paper print with P.O.P. or Bromide paper. Pass the dusting brush over both

sides. Lay the negative in the printing frame precisely as when making a paper print. Then take out one lantern plate (closing the box again) and place it film side downwards, *i.e.*, film to film with the negative. Now note carefully at this point that it is not quite so easy to see the difference between the coated and the glass side of a lantern plate as with an ordinary plate used for negative making. But if you stand a few yards away from your red lamp and catch the reflection of the lamp first on the glass and then on the coated side you will see this difference. The glass side shows you a sharply defined reflection while the coated side is softer and more fuzzy and less distinct. You will notice that the coating of emulsion on the plate is thinner and more transparent than on an ordinary plate. These points should all be carefully noted at the outset, as they will save you wasting plates afterwards by putting the lantern plate wrong way round into the printing frame—a thing beginners often do, resulting in much puzzlement. One more point. Bear in mind that the plates are packed film to film, two pairs in a wrapper, with glass side outside. This one fact alone

if remembered should be enough to prevent mistakes. Having put the two films together you can now hold the two plates together with the thumb edges, and at the same time hold up the printing frame and look through the lantern plate and negative towards the dark room lamp and so adjust the lantern plate so that it embraces just the part of the negative that you wish to convert into a positive transparency or slide. Then close the frame gently lest any sudden pressure breaks your negative. Breakage may easily come about if the negative does not lie truly snug and even in the rebate of the frame, or if a grain of sand or anything of that kind gets between the negative and plate.

Make the exposure just according to the suggestions given by the plate makers, *e.g.*, 20 seconds at 18 inches from a gas jet, or just whatever the paper advises. If you have the ingredients required for making up the developer recommended by the makers then do so, but if not we may for our trial plate fall back on our old and trusted friend Rodinal. As it is important to keep the plate bright and fogless we may try the following. In a

graduate put 20 minims of the 10 per cent. bromide solution, add 30 minims of Rodinal, and fill up to 1 oz. Then apply this to the plate just as though you were developing a negative. N.B.—Be careful about putting the exposed plate films side up in the developing dish. Now as the gelatin coating on a lantern slide is much thinner than it is on an ordinary negative plate the appearance of the developing lantern plate will be slightly different. That is to say, on looking through the plate we shall see more detail. Lantern plates vary, so no hard and fast rule can be given, but for our first plate we will carry development until we can see the picture fairly well shown on the back or glass side, and on looking through our plate we should find it quite as dark and contrastful as the finished slide is required to be. Probably we shall rather over-develop our first plate, but that will be a useful lesson in several ways.

The plate is now "fixed" in Hypo like a negative plate and then well washed and dried. Now, how are we to know that this—our first—lantern slide will be all right when shown in the lantern? The answer is that we cannot

know unless either we try it in a lantern *or* have experience to fall back upon, *or* have another slide with which to compare it. Therefore I suggest that it will be worth while for the beginner to invest a shilling in a good professionally made slide unless he can get some really expert slide-making friend to give or lend him one as a guide.

Let us return to our trial plate. Probably if shown on the screen with a lantern it will be found too dense, *i.e.*, does not permit enough light to pass through it, and this most likely is in this case due to over-developing.

Reducing and Brightening. Turn now to the section (p. 99) on reducing baths, and prepare a Hypo Ferricyanide reducing bath, and apply it to your slide, carefully watching the details in the shadows. The plate must be withdrawn from the reducer before these finest details are beginning to be attacked, and then well washed at once under a gentle stream of water from the tap. Many of our best lantern-slide makers purposely carry development a shade too far, and then slightly reduce so as to give the result a bright clean look, free from any trace of fog.

Test for Slide. Another good tip is this. Place the dry slide in contact with a piece of the finest ground glass such as is used for focussing screens—glass side of slide to smooth side of ground glass. Then hold up the two together and look through them towards a bright sky. One should in such a case be able to see details both in the shadows and also detail or gradation in the highest lights.

After Treatment. I need hardly say now that if we can reduce a slide we can if required intensify one. In short we can do to a slide or positive transparency anything which we can do to a negative.

Cover Glass. To protect a slide from injury it is customary to place in contact with its film side a piece of thin clean glass, and then

Fig. 34. Glass Cutter.

bind up or fasten the two glasses together. If you possess a diamond or glass cutter you can cut away just one inch from your spoiled negative plates, clean off the gelatin film with

a nail brush and *hot* water, and then use them for cover glasses—or in the same way spoiled lantern plates may be used without any cutting.

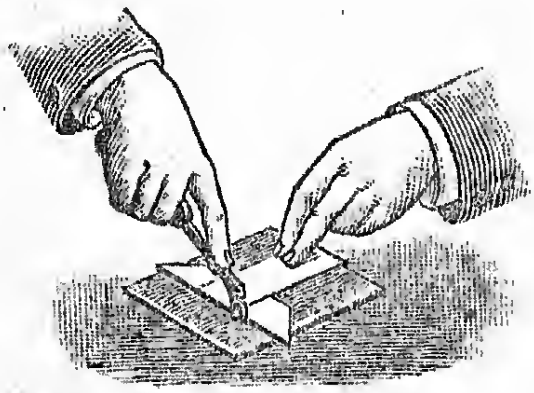

Fig. 35. Cover Glass Cutter.

The four edges of the pair of glasses are now fastened together by means of binding strips. These may be of paper, silk, metal, or other

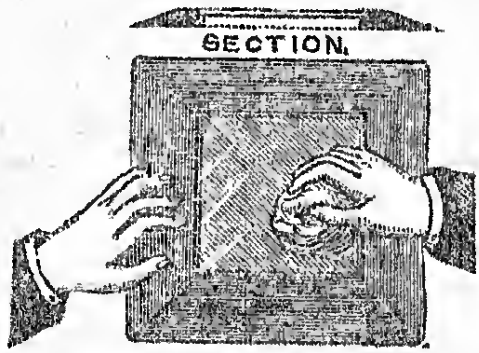

Fig. 36. Cover Glass Cleaner.

material. They are made in a useful variety of forms by the manufacturers of such things.

A Binding Clamp to hold the two glasses firmly together will be found a great convenience and time saver, as then both hands are set free to manipulate the binding operation.

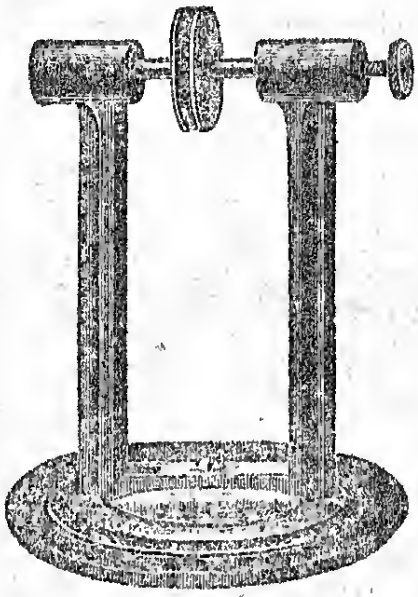

Fig. 37. Binding Clamp.

Masks. It seldom happens that the subject included on the slide is just exactly what we want to include in the picture. Moreover it is of a square shape, and this is seldom pictorial. Therefore we hide the part not wanted by a mask of some kind.

We can buy papers $3\frac{1}{4} \times 3\frac{1}{4}$ with holes of various kinds and sizes cut in them, or we can buy them with parallel lines ruled on them, so that we can with a penknife cut out the

shape we fancy for ourselves. In fact then we have quite a wide choice in the matter of masks.

Spotting. As there are eight ways of holding a slide to look through it and only one of these is the right way, therefore it is customary to put two little white spots on the right and left upper corners when the slide is held the right way round. These "spots" are sold as little white paper discs already gummed, also binding strips already "spotted" are buyable.

Toning. Lantern slides may be toned by various baths to quite a large variety of colours. But space does not permit me going into these matters here.

The Second Method. If we want to include the whole of the subject on a quarter plate, or indeed more than a square patch of 3 × 3 inches from any larger negative on our lantern slide, we cannot get this by contact. Therefore we set up the negative with a suitable arrangement of light behind it, point the camera at the negative, put a lantern plate in the camera, and take a photograph of the negative, which is our lantern slide or positive transparency.

For further details and instructions con-

cerning lantern slides the reader may refer to some of the many handbooks which are exclusively devoted to that subject.

Enlarging is perhaps the most interesting and certainly one of the most popular and useful methods of making photographic pictures. We can carry in the pocket a little camera with which we take negatives, a negative measuring perhaps 3 × 2 inches, and from this make a print 18 × 12 inches, which is quite suitable for framing and hanging on the wall.

The principle of enlarging is quite simple. When photographing an object, say the head of a sitter measuring 9 inches long, we get the image of the head perhaps one inch long. Then by reversing the process, *i.e.*, from the small negative image we can if we like make a print life size or any other size.

Now when producing our portrait negative observe that light travels (1) from the sitter, (2) through the lens, (3) to the plate. If now we cause light to travel the opposite way we get this order, (4) the negative, (5) the lens, and in place of the sitter (6) a piece of sensitive paper.

Daylight Methods. One of the simplest methods is indicated in fig 38. First we require a window on the north side of the house so that the sun does not shine directly upon it. The window is, temporarily blocked up with a frame work, attachable by means of turn buttons to the window frame. In this shutter we cut a hole exactly the size of the

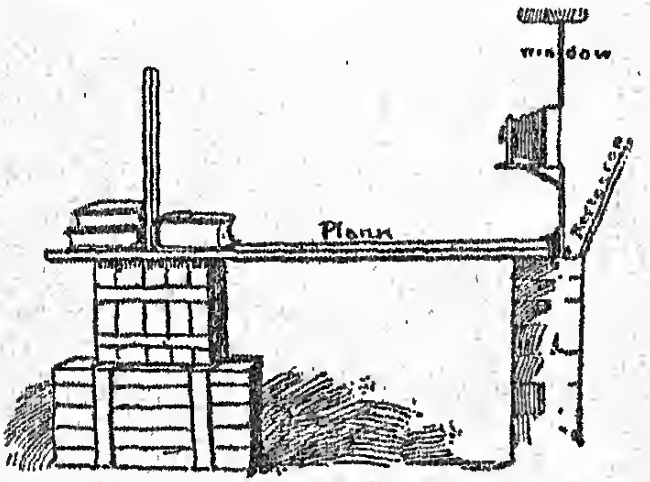

Fig. 38.

negative and attach two runners or grooves into which the negative slides and is held safely. Outside the window is temporarily placed a sheet of white card or a drawing board painted white or covered with white paper. This is now fixed at a slope, *i.e.*, just midway between vertical and horizontal, or at 45 degrees to vertical and horizontal. (In the

diagram the reflector is tilted up too near the vertical.) Next we fix (by means of brackets) a little horizontal shelf just below the opening for the negative. The ground glass of the camera used for taking the original negative is removed and the camera placed on the shelf with the open back close up to the negative, so that the lens is exactly opposite the centre of the negative. We may now use a board resting on the lower edge of the window sill at one end and supported horizontally at the other by a couple of empty packing cases. But a table is better and probably steadier and safer. On the table or box we fix up a drawing board in the vertical plane by means of some heavy books, or preferably a few bricks neatly covered with brown paper. On the board we fix by drawing pins a sheet of smooth white paper.

Focussing. Light coming vertically from the sky overhead falls on the reflector and is reflected horizontally through the negative, and then collected by the lens of the camera. By moving the drawing board to or from the camera we see our negative picture more or less in focus. We begin with the largest stop

of the lens and get the best focus we can for general sharpness. Then change the stop to the next smaller one and so on until the definition on the drawing board is satisfactory. Of course the reader will rightly conclude that all light must be shut out from the room except that passing through the negative and lens. Any chinks round the camera back, &c., can be stopped by folding the focussing cloth round these parts.

The lens is now capped or closed by means of the shutter. The bromide paper fixed on the board just where the picture was focussed,

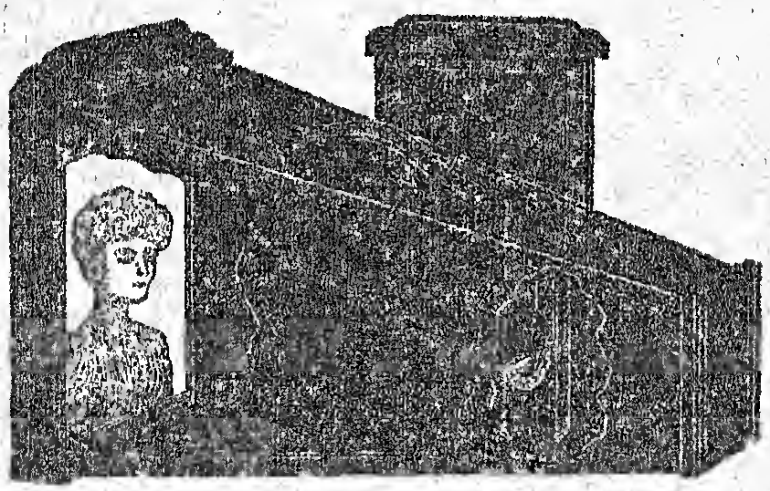

Fig. 39.

the exposure made by uncapping the lens, and then the paper developed in the usual way. Thus the matter is simplicity itself. But of

course one requires practice, which alone can come from experience, to get the best results.

The next figure (39) shows us a convenient and portable form of daylight enlarger, which does not necessitate blocking up a window. At one end of the camera is a "carrier" or holder for the negative. At the opposite end is a dark slide arrangement for holding the bromide paper; between the two is a lens with

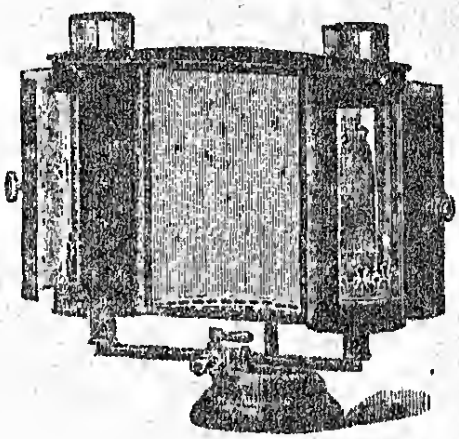

Fig. 40.

a sliding shutter. The camera is loaded up in the dark room with the shutter of the lens closed. It may now be carried into any room and pointed towards the sky. The lens shutter is opened for the requisite number of seconds and again closed, the apparatus taken to the dark room, the bromide paper taken out of the holder, and then developed.

Artificial Light. Perhaps the simplest method of evenly illuminating a negative by artificial light is shown in fig. 40. Two gas lamps throw a strong light on to a curved reflector. The negative is placed in front of the reflector and then the camera pointed towards it just as in the first method described.

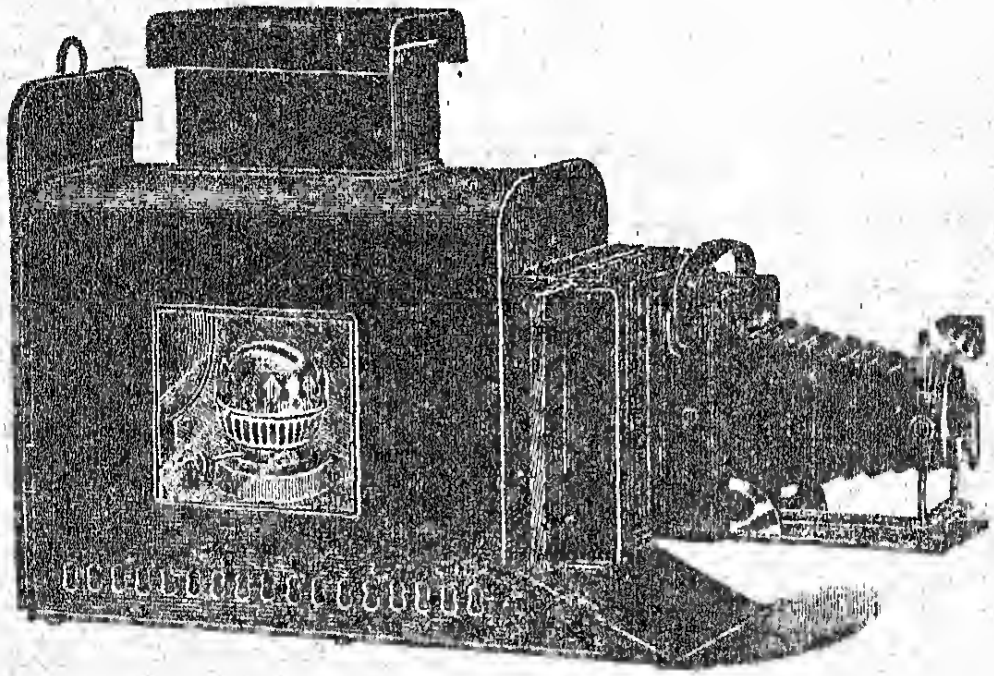

Fig. 41.

In the next figure (41) we have a somewhat different form, essentially the same in principle —but here the apparatus is for use with an oil lamp, while the camera is held on a little shelf just outside the negative and condenser.

In this latter case we require a room from which all light is shut out just as in the first arrangement, but here we are independent of daylight or gas.

I also give a diagram of a very useful and convenient form of easel which holds the paper flat against the board by means of strips of wood held by springs, which may be moved to any desired part of the board. Fig. 42.

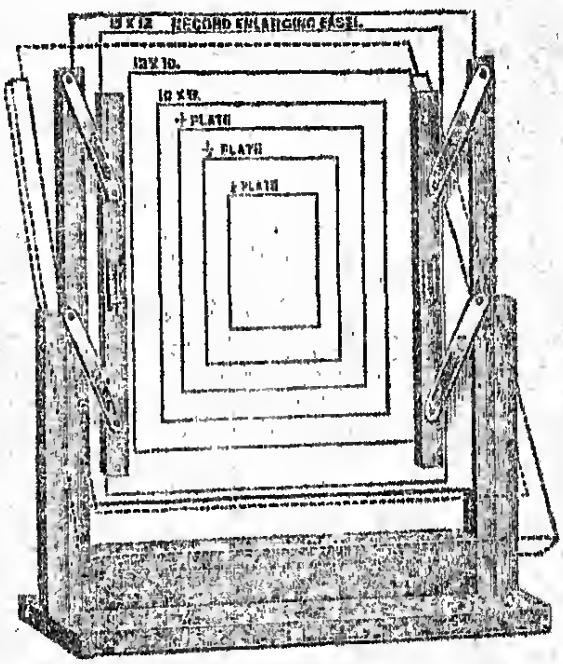

Fig. 42.

For further information about enlarging the reader should consult Messrs. Butcher's excellent pamphlet (obtainable gratis), "How can I enlarge."

Orthochromatic Plates and "Colour Screen" or "Ray Filters." Everybody nowadays knows that in old photographs blue objects came out white or very light, and red came out black or dark. Similarly the bright yellow buttercups in the young spring grass came out as black dots, the red poppies among the golden corn are also very much too dark if not black. The reason of this is that *ordinary* dry plates do not "see" colours as our eyes do. The ordinary plate "sees" blue and blue green as light, and "sees" yellow, orange, and red as dark. This was a serious trouble with photographers until it was found out that by mixing certain dyes with the gelatin-silver coating spread on the plate it became more sensitive or responsive to yellow, orange, and red. But while the plate's sight for colours was improved yet it still saw the blue and blue green too light. To correct this it still is necessary to put a pair of spectacles on the plate's eyes—in other words to put a yellow glass (or gelatine) screen on the lens, and so cut out some of the blueness.

A further improvement in plate making enables the manufacturer to make the plate

more responsive to red as well as green, thus we get vastly better renderings of green, yellow, orange, and red. In fact as this later plate is sensitive to all colours it is called *pan*-chromatic (from two Greek words pan and chroma, meaning "all" and "colour"). Pan-chromatic plates usually require a screen of a deeper colour (more orange-like) than ortho plates require for their correction or compensation.

Now our photographic image is caused by those rays which the object reflects, and consequently we have to consider two things, first the colour or kind of rays reflected, and secondly the quantity or amount. If the plate were equally responsive to all kinds of rays then we should only have to think of quantity, but this is not the case, therefore quality and quantity have both to be considered.

Now a moment's thought will show you that as it is the blue rays that are the most active, if we cut out a lot of these blue rays we shall have to compensate by making the exposures longer. Let us suppose that we use a screen which stops 5 out of 6 of our active rays, this means that we have now only one

active ray with a screen as compared with six rays without a screen. Consequently if one second be the right exposure without the colour screen we shall have to give six seconds with the screen. In that particular case we should call this a six-times or "6x-screen," *i.e.*, requiring six times as long with the screen as without it. Of course I only mention six by way of example, as the multiplying factors vary greatly,

While reading what has just been said I expect you have rightly been asking yourself, "How about the dark room red lamp?" If pan-chromatic plates are sensitive to red light when out at work in the field will they not be also sensitive to the light of the red lamp? The answer is yes—therefore if we do not want to fog our plates in the dark room we must learn to open the package of plate, load up the slides, &c., in absolute darkness. The developer must be prepared before the lamp is turned down. The developer is then poured on the plate in darkness, the developing dish covered over. Then we can turn on the red light, glance at our watch or dark room clock, and rock the covered dish until the proper

time for development has elapsed; then shield the lamp, and slip the plate from the developer into the fixing bath, and wait a few minutes before turning up the light again.

But what about ortho plates, which are not sensitive to red light? you ask. If you have a lamp which only permits red rays to get through it, then by keeping well away from the lamp and keeping the dish covered until the plate is nearly fully developed you can manage quite well without turning the light up and down. But there is a good deal in that "if." For as a matter of fact much of the red glass commonly used is not pure red. That is to say, that while a good deal of the light coming through is red yet with it is some green and dangerous light. You cannot see this green light with the eye because it is swamped, as it were, by the red, but it may be there all the same and can be shown to exist by a spectroscope. This does not mean that the lamp is useless—but it means that knowing the risk you run you must take corresponding care. For instance, when loading up, either do this in darkness (a matter easily learned) or get as far away from the lamp as you can,

and turn your back to the lamp so as to keep the plates protected by the shadow of the body.

If we use an ortho- (otherwise iso-) chromatic plate we find a slight improvement, but still the blue comes out too light. Therefore we have to stop back some but not all of the over-action blue rays. This we do by using a yellow "colour screen" or "ray filter," which permits yellow and red to pass through it freely, but permits only a small proportion of the blue rays to get through to the plate. In fact the yellow colour screen handicaps the over-action blue rays so as to give the less active rays a better chance. If the yellow screen cuts out too much blue then our blue objects come out too dark, which is as bad as being too light. Now you will see why just any bit of yellow glass will not "do" for a colour screen. The colour or filtering power of the screen requires to be correctly adjusted to suit the colour sensitiveness of the plate. And as this varies in different brands of "ortho" plates it is a wise plan to use the special colour screen which each plate-maker either supplies or advises to be used with his own manufactures. When once development

is well started exposure to dark room light does not seem nearly so harmful as it does before development has commenced.

Figs. 18 A and B show the effect of photographing a yellow buttercup with green leaves against an indigo blue background, under precisely similar conditions.

Fig. A shows the effect with an ordinary plate. Fig. B shows the effect with an orthochromatic plate and yellow colour screen.

Picture Making. The technicalities of our craft have already run away with so many pages that only a few are left for pictorial considerations. These must therefore be made as concise as possible. It should be clearly understood that the examples given are not put forward as perfect compositions, but have been especially selected to convey certain hints for beginners, and to point out probable mistakes.

Seaside Subjects. As most camera workers visit the seaside during the summer months they get the advantage of brilliant sunlight. The water also acts as a large and powerful reflector. Hence very rapid or brief exposures are possible with rapid plates and a large

stop. On the other hand, if we have dark or shadow-casting objects in the foreground, *e.g.*, boats, rocks, figures, we must bear in mind the golden rule of exposing for the shadows and developing for the high lights. In Fig. 17 we have a fairly typical example of a seaside snapshot taken in summer. Towards the right hand side there will be noticed a darkish corner where a mass of rocks give us some strong shadows. The exposure has not been quite sufficient for this dark corner, but about right for all other parts. This case then shows us that sometimes we have to stretch our rule of exposure a little bit and go for general effect, sacrificing any small and unimportant part. Had the exposure been based only on consideration of the dark rocks to the right the probabilities are that the rest of the picture would have suffered from over exposure. I mention this because it illustrates the exception and not the rule. As a rule it is *not* advisable to arrange your pictures so as to include important or dark foreground objects and extreme distance because of the difficulty of giving an adequate exposure for both parts.

When open sea (as in the example) is shown, it is advisable to keep the foreground as simple as possible. Care is required to guard against direct sunlight falling on the lens. The same caution applies to strong sunlight reflected by the water.

River Scenery forms a very attractive and beautiful class of work. Here again we get the advantage of skylight reflected by the water. In river scenes where the banks are wooded it is a very easy thing to go wrong in the matter of exposure. The young worker is misled by the bright light from the water and forgets that the trees are cutting off a great deal of the skylight. This is especially the case when the trees are leaf clad. Hence in woodland work, glades, ravines, and similar subjects one must be very careful to guard against under exposure.

In Fig. 19 we have an example of a rather difficult subject. Because we are confronted with two different subjects in one picture. On our right we have a heavy solid mass of summer foliage and on our left we have an open sunlit meadow. The dark part on our right requires about 20 times as much exposure

as the light part on the left. What are we to do? In this case we aim at giving just but only just enough exposure for the dark part, and then go to work very cautiously in developing, *i.e.*, using a weak developer and giving plenty of time. (For instance Rodinal, 5 drops per oz. of water.) In the original negative and print there is a slight indication of clouds, but this is almost lost during the process of reproduction. River and lake pictures often tempt one to include too much of the reflected picture, but this is a mistake, as the reflected picture if made too prominent is apt to weaken the whole effect.

Roadside and Cottage Scenery naturally often engages the cyclist's and pedestrian's attention, and very frequently many picturesque cottage studies can be found in unexpected corners. Do not get too near your work or you will find that the foreground objects, *e.g.*, garden gate, etc., is so large in proportion to the cottage that you hardly recognise your original when the print is made

In Fig. 25 we have a fairly typical example of what may be found in many parts of England. You will notice what a very great

help is obtained by the shadows. It is easy to see that the sun was shining, and on our right a tree not seen in the picture gives us help by casting a shadow on the road which prevents this part looking blank and monotonous.

When buildings of any kind are in the foreground or middle distance it is important that the plate during exposure be truly vertical or the building will not appear to be upright. In many roadside pictures we see the width of the road unduly exaggerated in the near foreground. This is often due to the use of a lens of too short focal length. The effect may frequently be mitigated by selecting a point of view nearer one side, *i.e.*, not in the middle of the road. A free use of the trimming knife is a welcome help. Whitewashed cottages with dark thatched roofs call for care in the matter of the exposure being ample but not excessive, and the development not pushed too far, or the white walls will come out like blank paper in the print. If any figures are included do not on any account let them stare at the camera, but let them be engaged in some ordinary occupation, *e.g.*, gardening,

Figures, Groups, &c. When human figures, cattle, &c., can be appropriately introduced or, what is still better, discovered in their natural occupations, the picture seems to have a lasting interest for us. But this class of subject is difficult, because it is not an easy matter to get cattle into just the right position, and many human subjects are still more difficult to deal with, for they will persist in assuming stiff wooden poses, and they will stare at the photographer and not at their work. The only thing to do in many cases is to watch and wait until they tire of staring, and then get them unawares. This usually means a rapid exposure, *i.e.*, a good light, large stop, and rapid plate.

In Fig. 24 we have two boys wrestling. It is pretty easy to see that they do not know very much about this art, but they thought they did and were tryirg their best to get a fall. Now the mistakes in this picture are worth pointing out. It was a mistake to include the buildings in the distance, and the seated figure on our left would be better omitted. The camera was too high above ground level, and the two boys are too central.

Now let us cover up a strip ⅛ inch wide along both the left and top margins, and we get a better result. This shows us how a free use of the trimming knife may often aid us.

If you cannot find your figures actually engaged in some natural occupation, then be careful that the occupation you suggest is natural, and on no account let your figures retire to put on their "best clothes."

Architecture. One of the greatest helps to the architectural photographer is some general, if slight, knowledge of the different styles of architecture. Because such a mental equipment enables him to discover or select the features best worth perpetuating. This need not be a very formidable affair. Indeed a very little knowledge of this kind acts as a revelation and gives one an Oliver Twist appetite for "more," so that the study of photography and of architecture go hand in hand. I mention this matter at length because I have suggested it to various friends who have acted on it and thanked me very warmly for opening out a new field of interest.

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